CHAPTER 3: FIVE-YEAR ACCIDENT HISTORY

The five-year accident history involves the reporting of significant accidental releases of one or more of the regulated substances from a covered process in the five years prior to the submission of an initial or updated Risk Management Plan (RMP). A five-year accident history must be completed for each covered process, including the processes in Program 1, and must include all accidental releases meeting specified criteria, as discussed below.

Note that a Program 1 process may have had an accidental release that must be included in the five-year accident history, even though the release does not disqualify the process from Program 1. The accident history criteria that make a process ineligible for Program 1 (certain offsite impacts) do not include other types of effects that require inclusion of a release in the five-year accident history (on-site impacts and more inclusive offsite impacts). For example, an accidental release may have led to worker injuries, but no other effects. This release would not bar the process from Program 1 (because the injuries were not offsite), but would need to be reported in the five-year accident history. Similarly, a release may have resulted in damage to offsite foliage (environmental damage), triggering reporting, but because the foliage was not part of an environmental receptor (e.g., national park or forest), it would not make the process ineligible for Program 1.

3.1 WHAT ACCIDENTS MUST BE REPORTED?

The five-year accident history covers only certain releases:

- The release must be from a covered process and involve a regulated substance held above its threshold quantity in the process.
- The release must have caused at least one of the following:
  - On-site deaths, injuries, or significant property damage (§68.42(a)); or
  - Known offsite deaths, injuries, property damage, environmental damage, evacuations, or sheltering in place (§68.42(a)).

If you have had a release of a regulated substance from a process where the regulated substance is held below its threshold quantity, you do not need to report that release even if the release caused one of the listed impacts or if the process is covered for some other substance. You may choose to report the release in the five-year accident history, but you are not required to do so.

3.2 WHAT DATA MUST BE PROVIDED?

The following information should be included in your accident history for every reported release:

Date. Indicate the date on which the accidental release began.

Time. Indicate the time at which the release began.

Release duration. Indicate the approximate length of time of the release in minutes.

Chemical(s). Indicate the regulated substance(s) released. Use the name of the substance as listed in § 68.130 rather than a synonym (e.g., ethylene oxide rather than oxirane). If the release was of a flammable mixture, list the primary regulated substances in the mixture if feasible; if the contents of the mixture are uncertain, list it as a flammable mixture.

Quantity released. Estimate the amount of each substance released in pounds. The amount should be estimated to two significant digits, or as close to that as possible. For example, if you estimate that the release was between 850 and 900 pounds, provide a best guess. We realize that you may not know precise quantities. For flammable mixtures, you may report the quantity of the mixture, rather than that of the individual regulated substances.

Release event. Indicate which of the following release events best describes your accident. Check all that apply:

- *Gas Release.* A gas release is a release of the substance as a gas (rather than vaporized from a liquid). If you hold a gas liquefied under refrigeration, report the release as a liquid spill.

- *Liquid Spill/ Evaporation.* A liquid spill/evaporation is a release of the substance in a liquid state with subsequent vaporization.

- *Fire.* A fire is combustion producing light, flames, and heat.

- *Explosion.* An explosion is a rapid chemical reaction with the production of noise, heat, and violent expansion of gases.

- *Uncontrolled/Runaway Reaction*. A release event caused by an uncontrolled chemical reaction that generates excessive heat, pressure, or harmful reaction products. Such events may involve highly exothermic chemical reactions, self-reactive substances (e.g., substances that undergo polymerization), unstable, explosive, or spontaneously combustible substances, substances that react strongly with water or other contaminants, oxidizers, peroxide-forming substances, or other types of chemical reactions that generate harmful products or byproducts. This category of release event may often occur in conjunction with one of the previous categories. In such cases, be sure to check this category in addition to any other applicable release event category (e.g., explosion). The burning of ordinary flammable substances is not typically included in this category.

Release source. Indicate all that apply.

- *Storage Vessel.* A storage vessel is a container for storing or holding gas or liquid. Storage vessels include transportation containers being used for on-site storage.

- *Piping.* Piping refers to a system of tubular structures or pipes used to carry a fluid or gas.

- *Process Vessel.* A process vessel is a container in which substances under certain conditions (e.g., temperature, pressure) participate in a process (e.g., substances are manufactured, blended to form a mixture, reacted to convert them into some other final product or form, or heated to purify).

- *Transfer Hose.* A transfer hose is a tubular structure used to connect, often temporarily, two or more vessels.

- *Valve.* A valve is a device used to regulate the flow in piping systems or machinery. Relief valves and rupture disks open to release pressure in vessels.

- *Pump.* A pump is a device that raises, transfers, or compresses fluids or that attenuates gases by suction or pressure or both.

- *Joint.* The surface at which two or more mechanical components are united.

- *Other.* Specify other source of the release.

Weather conditions at time of event (if known). This information is important to those concerned with modeling the effects of accidents. Reliable information from those involved in the incident or from an on-site weather station is ideal. However, this rule does not require your facility to have a weather station. If you do not have an onsite weather station, use information from your local weather station, airport, or other source of meteorological data. To the extent possible, complete the following:

- *Wind Speed and Direction.* Wind speed is an estimate of how fast the wind is traveling. Indicate the speed in miles per hour. Wind direction is the direction from which the wind comes. For example, a wind that blows from east to west would be described as having an eastern wind direction. You may describe wind direction as a standard compass reading such as "Northeast" or "South-southwest."

  You may also describe wind direction in degrees--with North as zero degrees and East as 90 degrees. Thus, northeast would represent 45 degrees and south-southwest would represent 202.5 degrees. Abbreviations for the wind direction such as NE (for northeast) and SSW (for south-southwest) are also acceptable.

- *Temperature.* The ambient temperature at the scene of the accident in degrees Fahrenheit. If you did not keep a record, you can use the high (for

daytime releases) or low (for nighttime releases) for the day of the release. Local papers publish these data.

- *Stability Class*. Depending on the amount of incoming solar radiation as well as other factors, the atmosphere may be more or less turbulent at any given time. Meteorologists have defined six atmospheric stability classes, each representing a different degree of turbulence in the atmosphere. When moderate to strong incoming solar radiation heats air near the ground, causing it to rise and generating large eddies, the atmosphere is considered unstable, or relatively turbulent. Unstable conditions are associated with stability classes A and B. When solar radiation is relatively weak, air near the surface has less of a tendency to rise and less turbulence develops. In this case, the atmosphere is considered stable or less turbulent with weak winds. The stability class is E or F. Stability classes D and C represent conditions of neutral stability or moderate turbulence respectively. Neutral conditions are associated with relatively strong wind speeds and moderate solar radiation. Exhibit 3-1 presents the stability classes associated with wind speeds, time of day, and cloud cover.

- *Precipitation Present.* Precipitation may take the form of hail, mist, rain, sleet, or snow. Indicate "yes" or "no" based on whether there was any precipitation at the time of the accident.

- *Unknown*. If you have no record for some or all of the weather data, indicate "unknown" for any missing item. We realize that you may not have weather data for accidents that occurred in the past. You should, however, collect these data for any future accidents.

EXHIBIT 3-1
ATMOSPHERIC STABILITY CLASSES

SURFACE WIND SPEED AT 10 METERS		DAY			NIGHT	
		Incoming Solar Radiation			Thinly Overcast or ≥ 4/8 low cloud	≤ 3/8 Cloud
Meters per second	Miles per hour	Strong*	Moderate	Slight**		
< 2	<4.5	A	A-B	B		
2-3	4.5-7	A-B	B	C	E	F
3-5	7-11	B	B-C	C	D	E
5-6	11-13	C	C-D	D	D	D
>6	>13	C	D	D	D	D

* Sun high in the sky with no clouds.
** Sun low in the sky with no clouds.

On-site impacts. Complete the following about on-site effects.

- *Deaths.* Indicate the number of on-site deaths that are attributed to the accident or mitigation activities. On-site deaths means the number of employees, contract employees, offsite responders, or others (e.g., visitors) who were killed by direct exposure to toxic concentrations, radiant heat, or overpressures from accidental releases or from indirect consequences of a vapor cloud explosion from an accidental release (e.g., flying glass, debris, other projectiles). You should list employee/contractor, offsite responder, and other on-site deaths separately.

- *Injuries.* An injury is any effect that results either from direct exposure to toxic concentrations, radiant heat, or overpressures from accidental releases or from indirect consequences of a vapor cloud explosion (e.g., flying glass, debris, other projectiles) from an accidental release and that requires medical treatment or hospitalization. You should list injuries to employees and contractors, offsite responders, and others separately.

  Medical treatment means treatment, other than first aid, administered by a physician or registered professional personnel under standing orders from a physician.

  Your Log of Work-Related Injuries and Illnesses (OSHA Form 300) and Injury and Illness Incident Report (OSHA Form 301) will help complete these items for employees.

- *Property Damage.* Estimate the value of the equipment or business structures (for your business alone) that were damaged by the accident or mitigation activities. Record the value in American dollars. Insurance claims may provide this information. Do **not** include any losses that you may have incurred as a result of business interruption.

Qs & As
Property Damage

Q. What does significant on-site property damage mean?

A. Any on-site property damage that exceeds $50,000 would be considered significant. Depending on your circumstances, lesser levels of damage may also be significant. You must make a reasonable judgment as to what level of damage is significant for your facility.

Q. What level of offsite property damage triggers reporting?

A. Any level of known offsite property damage triggers inclusion of the accident in the five-year accident history. You are not required to conduct a survey to determine if such damage occurred, but if you know, or could reasonably be expected to know (e.g., because of reporting in the newspapers), that damage occurred, you must include the accident.

Known offsite impacts. These are impacts that you know or could reasonably be expected to know of (e.g., from media reports or from reports to your facility) that occurred as a result of the accidental release. You are not required to conduct an additional investigation to determine offsite impacts.

- *Deaths.* Indicate the number of offsite deaths that are attributable to the accident or mitigation activities. Offsite deaths means the number of community members who were killed by direct exposure to toxic concentrations, radiant heat, or overpressures from accidental releases or from indirect consequences of a vapor cloud explosion from an accidental release (e.g., flying glass, debris, other projectiles).

- *Injuries.* Indicate the number of injuries among community members. Injury means any effect that results either from direct exposure to toxic concentrations, radiant heat, or overpressures from accidental releases or from indirect consequences of a vapor cloud explosion from an accidental release (e.g., flying glass, debris, other projectiles) and that requires medical treatment or hospitalization.

- *Evacuated.* Estimate the number of members of the community who were evacuated to prevent exposure that might have resulted from the accident. A total count of the number of people evacuated is preferable to the number of houses evacuated. People who were ordered to move simply to improve access to the site for emergency vehicles are not considered to have been evacuated.

- *Sheltered.* Estimate the number of members of the community who were sheltered-in-place during the accident. Sheltering-in-place occurs when community members are ordered to remain inside their residence or place of work until the emergency is over to prevent exposure to the effects of the accidental release. Usually these orders are communicated by an emergency broadcast or similar method of mass notification by response agencies.

- *Environmental Damage.* Indicate whether any environmental damage occurred and specify the type. The damage to be reported is not limited to environmental receptors listed in the rule. Any damage to the environment (e.g., dead or injured animals, defoliation, water contamination) should be identified. You are **not**, however, required to conduct surveys to determine whether such impact occurred. Types of environmental damage include:

  - Fish or animal kills.
  - Lawn, shrub, or crop damage (minor defoliation).
  - Lawn, shrub, or crop damage (major defoliation).
  - Water contamination.
  - Other (specify).

Initiating event. Indicate the initiating event that was the immediate cause of the accident, if known. If you conducted an investigation of the release, you should have identified the initiating event.

- *Equipment Failure.* A device or piece of equipment failed or did not function as designed. For example, the vessel wall corroded or cracked.
- *Human Error.* An operator performed a task improperly, either by failing to take the necessary steps or by taking the wrong steps.
- *Weather Conditions.* Weather conditions, such as lightning, hail, ice storms, tornados, hurricanes, floods, or high winds, caused the accident.
- *Unknown.*

Contributing factors. These are factors that contributed to the accident, but were not the initiating event. If you conducted an investigation of the release, you may have identified factors that led to the initiating event or contributed to the severity of the release. Indicate all that apply.

- *Equipment Failure.* A device or piece of equipment failed to function as designed, thereby leading to or worsening the accidental release.
- *Human error.* An operator performed an operation improperly or made a mistake leading to or worsening the accidental release.
- *Improper Procedures.* The procedure did not reflect the proper method of operation, the procedure omitted steps that affected the accident, or the procedure was written in a manner that allowed for misinterpretation of the instructions.
- *Overpressurization.* The process was operated at pressures exceeding the design working pressure.
- *Upset Condition.* Incorrect process conditions (e.g., increased temperature or pressure) contributed to the release.
- *By-pass Condition.* A failure occurred in a pipe, channel, or valve that diverts fluid flow from the main pathway when design process or storage conditions are exceeded (e.g., overpressure). By-pass conditions may be designed to release the substance to restore acceptable process or storage conditions and prevent more severe consequences (e.g., explosion).
- *Maintenance Activity/ Inactivity.* A failure occurred because of maintenance activity or inactivity. For example, the storage racks remained unpainted for so long that corrosion caused the metal to fail.

- *Process Design.* A failure resulted from an inherent flaw in the design of the process (e.g., pressure needed to make the product exceeds the design pressure of the vessel).

- *Unsuitable Equipment.* The equipment used was incorrect for the process. For example, the forklift was too large for the corridors.

- *Unusual Weather Conditions.* Weather conditions, such as lightning, hail, ice storms, tornados, hurricanes, floods, or high winds contributed to the accident.

- *Management Error.* A failure occurred because management did not exercise its managerial control to prevent the accident from occurring. This is usually used to describe faulty procedures, inadequate training, inadequate oversight, or failure to follow existing administrative procedures.

Whether offsite responders were notified. If known, indicate whether response agencies (e.g., police, fire, medical services) were contacted.

Changes introduced as a result of the accident. Indicate any measures that you have taken at the facility to prevent recurrence of the accident. Indicate all that apply.

- *Improved/ Upgraded Equipment.* A device or piece of equipment that did not function as designed was repaired or replaced.

- *Revised Maintenance.* Maintenance procedures were clarified or changed to ensure appropriate and timely maintenance including inspection and testing (e.g., increasing the frequency of inspection or adding a testing method).

- *Revised Training.* Training programs were clarified or changed to ensure that employees and contract employees are aware of and are practicing correct safety and administrative procedures.

- *Revised Operating Procedures.* Operating procedures were clarified or changed to ensure that employees and contract employees are trained on appropriate operating procedures.

- *New Process Controls.* New process designs and controls were installed to correct problems and prevent recurrence of an accidental release.

- *New Mitigation Systems.* New mitigation systems were initiated to limit the severity of accidental releases.

- *Revised Emergency Response Plan.* The emergency response plan was revised.

- *Changed Process.* Process was altered to reduce the risk (e.g., process chemistry was changed).

- *Reduced Inventory.* Inventory was reduced at the facility to reduce the potential release quantities and the magnitude of the hazard.

- *Other.*

- *None.* No changes initiated at facility as a result of the accident (e.g., because none were necessary or technically feasible). There may be some accidents that could not have been prevented because they were caused by events that are too rare to merit additional steps. For example, if a tornado hit your facility and you are located in an area where tornados are very rare, it may not be reasonable to design a "tornado proof" process even if it is technically feasible.

3.3 WHEN MUST ACCIDENTS BE REPORTED?

When an RMP is first submitted to EPA, it must contain a five-year accident history including all of the accidents that meet the reporting criteria discussed above and that occurred within five years of the date of the RMP is submitted. When an RMP is updated as required by section 68.190 of the rule, it must contain an updated five-year accident history including all of the accidents that meet the reporting criteria and that occurred within five years of the date on which the updated RMP is submitted. In addition, on April 9, 2004, EPA published a final rule that amended the accident history reporting requirement (and certain other provisions of the risk management program). Beginning on that date, if an accident occurs that meets the reporting criteria, it must be reported in the RMP five-year accident history within six months of the accident, as required by section 68.195 of the rule, unless it is included in an RMP update prior to that time. EPA took this action to require more timely reporting of significant accidents in RMPs so that government, industry and the public would be more quickly alerted to the possibility of similar accidents occurring elsewhere.

3.4 OTHER ACCIDENT REPORTING REQUIREMENTS

You should already have much of the data required for the five-year accident history because of the reporting requirements under the Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA), EPCRA, and OSHA (e.g., log of work-related injuries and illnesses). This information should minimize the effort necessary to complete the accident history.

At the same time, some of the information originally reported to response agencies may have been incomplete or inaccurate because it was reported during the release when a full assessment was not possible. It is imperative that you include the most accurate, up-to-date information possible in the five-year accident history. This information may not always match the original estimates from the initial reporting of the accident's effects.

CERCLA Section 103(a) requires you to immediately notify the National Response Center if your facility releases a hazardous substance to the environment in greater than a reportable quantity (see 40 CFR part 302). Toxic substances regulated under

part 68 are also CERCLA hazardous substances, but most of the flammable substances regulated under part 68 are not subject to CERCLA reporting. Notice required under CERCLA includes the following information:

- The chemical name or identity of any substance involved in the release
- An indication of whether the substance is on the list referred to in Section 302(a)
- An estimate of the quantity of substance that was released into the environment
- The time and duration of the release
- The medium or media into which the release occurred.

EPCRA Section 304 requires facilities to report to the community emergency coordinator of the appropriate local emergency planning committee (LEPC) and state emergency response commission (SERC) releases of extremely hazardous substances to the environment in excess of reportable quantities (as set forth in 40 CFR part 302). All toxic substances regulated under part 68 are subject to EPCRA reporting; flammables regulated under part 68 are generally not subject to EPCRA reporting. The report required by EPCRA is to include:

- Chemical name or identity of all substances involved in the accident
- An estimate of the quantity of substances released to the environment
- The time and duration of the release.

The owner or operator is also required to release a Follow-up Emergency Notice as soon as possible after a release which requires notification. This notice should update the previously released information and include additional information regarding actions taken to respond to the release, any known or anticipated acute or chronic health risks associated with the release, and where appropriate, advice regarding medical attention necessary for exposed individuals.

OSHA's Log of Work-Related Injuries and Illnesses, OSHA Form 300, is used for recording and classifying recordable occupational injuries and illnesses, and for noting the extent and outcome of each case. The log shows when the occupational injury or illness occurred, to whom, what the injured or ill person's regular job was at the time of the injury or illness exposure, the kind of injury or illness, how much time was lost, and whether the case resulted in a fatality, etc. The following are the sections of the illness/ injury log that are useful in completing the accident history.

- **Column B:** Employee’s name
- **Column C:** Job title

- **Column D:** Date of injury or onset of illness
- **Column F:** Description of injury or illness
- **Columns G, H, I, K, L:** Indicate whether a death occurred, whether injury resulted in lost workdays or restricted duty, and number of work days away form work or on restricted duty.
- **Column M:** Indicates whether injury occurred or type of illness.

PART 68 INCIDENT INVESTIGATION

An incident investigation is a requirement of the rule (§68.60 and 68.81). For accidents involving processes in Program 2 or Program 3, you must investigate each incident which resulted in, or could reasonably have resulted in, a catastrophic release of a regulated substance. A report, which includes the following information, should be prepared at the conclusion of the investigation:

- Date of incident
- Date investigation began
- Description of the incident
- Factors that contributed to the incident
- Any recommendations resulting from the investigation.

Because the incident investigation report must be retained for five years, you will have a record for completing the five-year accident history for updates of the RMP.

QS & AS
ACCIDENT HISTORY

Q. When does the five-year period to be reported in the accident history begin?

A. The five-year accident history must include information on all accidental releases from covered processes meeting the specified criteria that occurred in the five years preceding the date of submission of your initial RMP or your most recent update required under section 68.190, as well as information provided to revise the accident history for any accidental releases that occur prior to the next required update. For example, if an RMP is updated on June 21, 2004, the five-year accident history must cover the period between June 21, 1999, and June 21, 2004. If a reportable accident occurs two months later, the five-year accident history must cover the period between June 21, 1999, and the date of the accident (see next question for further explanation).

Q. I recently submitted my five-year RMP update required by section 68.190 (b)(1) and included my accident history for the previous five years. Two months later, we had another reportable accident. Do I have to do anything to revise my RMP?

A. Yes. You must revise your accident history within six months of the date of the new accident to include information about it. You do this by submitting an RMP that corrects section 6 (the accident history section) so that it includes all accident history information reported on the most recent update, as well as the information about the new accident. You should also indicate the reason for your correction (i.e., new accident history information) in the appropriate field in section 1 of RMP*Submit. Facilities reporting under Programs 2 and 3 must also revise the incident investigation information in their RMPs (section 7 or 8 of their RMP). Specifically, the date of investigation (40 CFR 68.170(j)) and the expected date of completion of any changes (40 CFR 68.175(l)) should be revised. You do not need to update or correct any other section of the RMP, unless you have taken actions (e.g., as a result of the accident) that trigger an update in accordance with section 68.190.

QS & AS
ACCIDENT HISTORY (CONTINUED)

Q. If a facility has recently changed ownership, is the new facility owner required to include accidents which occurred prior to the transfer of ownership in the accident history portion of the RMP submitted for the facility?

A. Yes, accidents involving covered processes that occurred prior to the transfer of ownership should be included in the five-year accident history. You may want to explain that the ownership has changed in your Executive Summary.

Q. If I have a large on-site incident, but no offsite impact, would I have to report it in the five-year accident history?

A. It would depend on whether you have onsite deaths, injuries, or significant property damage. You could have a large accident without any of these consequences (e.g., a large spill that was contained); this type of release would not have to be included in the five-year accident history.

Q. I had a release where several people were treated at the hospital and released; they attributed their symptoms to exposure. We do not believe that their symptoms were in fact the result of exposure to the released substance. Do we have to report these as offsite impacts?

A. Yes, you should report them in your five-year accident history. You may want to use the executive summary to state that you do not believe that the impacts can be legitimately attributed to the release and explain why.

CHAPTER 4: OFFSITE CONSEQUENCE ANALYSIS

RMP OFFSITE CONSEQUENCE ANALYSIS GUIDANCE

This chapter is intended for people who plan to do their own air dispersion modeling. If you plan to do your own modeling, this chapter will provide you with the basic information you need to comply with the rule requirements; it does not provide modeling methodologies. For people who do not plan to do their own modeling, EPA has prepared a separate document, *RMP Offsite Consequence Analysis Guidance,* which provides simple methods and reference tables for determining distance to an endpoint for worst-case and alternative release scenarios. In conjunction with the National Oceanographic and Atmospheric Administration (NOAA), EPA has also developed a software program, RMP*Comp™, that performs calculations described in the *RMP Offsite Consequence Analysis Guidance.* RMP*Comp™ is available for free from the EPA Internet website at http://yosemite.epa.gov/oswer/CeppoWeb.nsf/content/rmp-comp.htm. In addition, EPA has developed industry-specific guidance for several industries covered by part 68, which are appended to this document. In the appendices, EPA provides chemical-specific modeling for the applicable industries, using the methods described in the *RMP Offsite Consequence Analysis Guidance.*

4.1 INTRODUCTION

The offsite consequence analysis consists of two elements:

- **Worst-case release scenario** analysis to identify the potential reach and effect of hypothetical worst-case accidental releases, as follows:
  - For a process to qualify for Program 1 (see Chapter 2), a worst-case release scenario analysis must be done for each toxic and flammable substance held above the applicable threshold quantity in the process. The process is eligible for Program 1 if there are no public receptors within the distance to an endpoint for any of the worst-case scenarios analyzed and the other Program 1 criteria are met (see Chapter 2). Consequently, for every Program 1 process, you must conduct a worst-case scenario analysis for each regulated substance above the threshold in the process. However, in your RMP the only worst-case scenario analysis you must report for a Program 1 process is for the toxic or flammable substance that, if released under worst-case conditions, would potentially effect the largest geographical area around your facility. In the language of the rule, such a scenario results "in the greatest distance to an endpoint," meaning that the dangerous effect of the toxic or flammable substance extends the longest distance before dissipating to relatively harmless levels.
  - If your site has Program 2 and/or Program 3 processes (processes that are not eligible for Program 1 — see Chapter 2), you must identify, analyze and report one worst-case scenario to represent all of the toxic regulated substances held above threshold quantities in

Program 2 and/or 3 processes (i.e., the worst-case release of the toxic substance that results in the greatest distance to endpoint,), and one worst-case scenario to represent all of the flammable regulated substances held above threshold quantities in Program 2 and/or 3 processes (i.e., the worst-case release of the flammable substance that results in the greatest distance to endpoint).

- You may need to submit an additional worst-case analysis if a worst-case release from elsewhere at your facility could potentially affect public receptors different from those potentially affected by the initial worst-case scenario(s).

- **Alternative release scenario** analysis to identify the potential reach and effect of hypothetical accidental releases under more realistic circumstances, for all Program 2 and Program 3 processes, as follows:

  - You must identify and analyze reasonable release scenarios that are more likely to occur than worst-case release scenarios and that reach an off-site endpoint, unless no such scenario exists.

  - In your RMP, you must report one alternative release scenario analysis for each regulated toxic substance held above the applicable threshold quantity in a Program 2 or 3 process, including the substance considered in a worst-case analysis.

  - In your RMP, you must also report one alternative release scenario representing all flammable substances held above the applicable threshold quantity in a Program 2 or 3 process.

If the distance to the endpoint for your worst-case release just reaches your fence line, you may not have an alternative release scenario with a distance to an endpoint that goes beyond the fence line. However, you still must report an alternative release scenario.

HOW SHOULD I CONDUCT THE ANALYSIS?

As noted above, You may use EPA's *RMP Offsite Consequence Analysis* Guidance to carry out your consequence analysis. Results obtained using the methods in EPA's Guidance are expected to be conservative. Conservative assumptions have been introduced to compensate for high levels of uncertainty. EPA's guidance is optional, and you are free to use other air dispersion models, fire or explosion models, or computation methods provided that:

- They are publicly or commercially available or are proprietary models that you are willing to share with the implementing agency;

- They are recognized by industry as applicable to current practices;

- They are appropriate for the chemicals and conditions being modeled;

- You use the applicable definitions of worst-case scenarios; and
- You use the applicable parameters specified in the rule.

Complex models that can account for many site-specific factors may give less conservative estimates of offsite consequences than the simplified methods in EPA's guidance, particularly for alternative scenarios, for which EPA has not specified

EXHIBIT 4-1
CONSIDERATIONS FOR CHOOSING A MODELING METHOD

Approach	Examples	Advantages	Disadvantages
Simple guidance	EPA's *Offsite Consequence Analysis Guidance*	✦ Free ✦ No computer requirements ✦ Simple to use ✦ Provides all data needed ✦ Provides tables of distances ✦ Eases compliance with rule	✦ Conservative results ✦ Few site-specific factors considered ✦ Little flexibility in scenario development
Simple computer models	EPA models, such as RMP*Comp™	✦ No/low cost ✦ May be simple to use ✦ Can consider some site-specific factors	✦ Some may not be simple to use ✦ Likely to give conservative results ✦ May not accept all of EPA's required assumptions ✦ May not include chemical-specific data ✦ May not address all consequences
Complex computer models	Commercially available models	✦ May address a variety of scenarios ✦ May consider many site-specific factors	✦ May be costly ✦ May require high level of expertise
Calculation methods	"Yellow Book" (Netherlands TNO)	✦ Low cost ✦ No computer requirements	✦ May require expertise to apply methods ✦ May require development of a variety of data

many assumptions. However, complex models may be expensive and require considerable expertise to use; EPA's optional guidance is designed to be simple and straightforward. You will need to consider the tradeoff in deciding how to carry out your required consequence analyses. Exhibit 4-1 provides additional suggestions on making this decision.

Whether you use EPA's guidance or another modeling method, you should bear in mind that the results you obtain from modeling your worst-case or alternative

scenarios should not be considered to predict the likely results of an accidental release. The worst-case assumptions are very conservative, and, regardless of the model used, you can expect very conservative results. Results from modeling alternative scenarios will be less conservative; however, you still must use conservative endpoints.

In addition, results of an actual release will depend on many site-specific conditions (e.g., wind speed and other weather conditions) and factors related to the release (e.g., when and how the release occurs, how long it takes to stop it). You should make reasonable assumptions regarding such factors in developing your alternative scenarios, but the circumstances surrounding an actual release may be different. Different models likely will provide different results, even with the same assumptions, and most models have not been verified with experimental data; therefore, results of even sophisticated modeling have a high degree of uncertainty and should be viewed as providing a basis for discussion among the regulated community, emergency planners and responders, and the public, rather than predictions. Modeling results should be considered particularly uncertain over long distances (i.e., 10 kilometers or more).

Exhibit 4-2 provides suggestions for assistance on modeling.

WHEN DOES THE OFFSITE CONSEQUENCE ANALYSIS (OCA) NEED TO BE REVISED?

You'll need to revise your OCA when a change at your facility results in the distance to an endpoint from a worst-case release rising or falling by at least a factor of two. For example, if you increase your inventory substantially or install passive mitigation to limit the potential release rate, you should re-estimate the distance at an endpoint. If the distance is at least doubled or halved, you must update and res-submit the RMP. For most substances, the quantity that would be released would have to increase (or decrease) by more than a factor of five to double (or halve) the distance to an endpoint. Depending on the regulated substance, installation of passive mitigation systems such as containment dikes or enclosures can significantly affect the distance to an endpoint.

4.2 WORST-CASE RELEASE SCENARIOS

This section describes the assumptions you must make and what you need to do to meet the requirements for worst-case scenario analysis under the rule. Exhibit 4-3 summarizes the required parameters for the worst-case analysis. EPA has defined a worst-case release as the release of the largest quantity of a regulated substance from a vessel or pipe that results in the greatest distance from the point of release to a specified endpoint, beyond which serious injury is not expected to occur (§68.3). You must estimate the distance as follows:

- Part 68, Appendix A lists the toxic endpoint you must use for each regulated toxic substance. For the worst-case analysis for toxic substances, you are required to estimate the air dispersion distance to the endpoint, using certain conservative assumptions concerning quantity released and release conditions.

- A vapor cloud explosion is specified as the worst-case scenario for flammable substances. For the worst-case analysis for flammable substances, you need to estimate the distance to an overpressure endpoint of 1 pound per square inch (psi) resulting from a vapor cloud explosion of a cloud containing the largest quantity of the regulated flammable substance from a vessel or process pipe line failure.

EXHIBIT 4-2
POSSIBLE SOURCES OF ASSISTANCE ON MODELING

- You may be able to obtain modeling help from the implementing agency in your area; for example, local and state implementing agencies in Delaware, Florida, Georgia, and other "delegated" states (see Chapter 10) are prepared to provide assistance to regulated sources. If you are in another state, you may obtain help from the EPA regional office for your state.
- If you use certain models, users' groups may be a source of assistance; for example, there is an ALOHA model users' group.
- If you use a commercial model, you probably can request assistance from the model developer or distributor.
- Publications of the Center for Process Safety of the American Institute of Chemical Engineers (AIChE) may provide useful information on modeling; examples of such publications include:
  - *Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs* (1994), and
  - *Guidelines for Use of Vapor Cloud Dispersion Models* (1987).
- EPA publications also may provide useful modeling information; examples include:
  - *Workbook of Screening Techniques for Assessing Impacts of Toxic Air Pollutants*, EPA-450/4-88-009 (September 1988), and
  - *Guidance on the Application of Refined Dispersion Models for Hazardous/Toxic Air Release*, EPA-454/R-93-002 (May 1993).
  - *Technical Background Document for Offsite Consequence Analysis for Anhydrous Ammonia, Aqueous Ammonia Chlorine, and Sulfur Dioxide* EPA-550-B99-017.
  - EPA guidance is available at the Support Center for Regulatory Air Models: http://www.epa.gov/scram001//

WORST-CASE RELEASES OF TOXIC SUBSTANCES

For the worst-case release analysis for toxic substances, you need to use the assumptions discussed below, the properties of the substance, and an appropriate air dispersion model or EPA's optional guidance to estimate the distance from the release point to the point at which the concentration of the substance in air is equal to the toxic endpoint specified in the rule. Because the assumptions required for the worst-case analysis are very conservative, the results likely will also be very conservative. The endpoints specified for the regulated toxic substances are intended to be protective of the general public. These endpoints are concentrations below which it is believed nearly all individuals could be exposed for one-half to one hour without any serious health effects. In addition, the worst-case analysis is carried out using very conservative assumptions about weather and release conditions. The distance to the endpoint estimated under worst-case conditions should not be considered a zone in which the public would likely be in danger; instead, it is intended to provide an estimate of the maximum possible area that might be affected in the unlikely event of catastrophic conditions. Distances greater than about 10 kilometers are particularly uncertain. EPA intends the estimated distances to provide a basis for a discussion among the regulated community, emergency planners and responders, and the public, rather than a basis for any specific predictions or actions.

MODELING ASSUMPTIONS

Quantity. EPA has defined (§68.3) a worst-case release as the release of the largest quantity of a regulated substance from a vessel or process line (pipe) failure that results in the greatest distance to a specified endpoint. For substances in vessels, you must assume release of the largest amount in a single vessel; for substances in pipes, you must assume release of the largest amount in a pipe. The largest quantity should be determined taking into account administrative controls. Administrative controls are written procedures that limit the quantity of a substance that can be stored or processed in a vessel or pipe at any one time, or, alternatively, occasionally allow a vessel or pipe to store larger than usual quantities (e.g., during turnaround). You do not need to consider the possible causes of the worst-case release or the probability that such a release might occur; the release is simply assumed to take place.

Release Height. All releases are assumed to take place at ground level for the worst-case analysis. This is a conservative assumption in most cases. Even if you think a ground-level release is unlikely at your site, you must use this assumption for the worst-case analysis.

Wind Speed and Atmospheric Stability. Meteorological conditions for the worst-case scenario are defined in the rule as atmospheric stability class F (stable atmosphere) and wind speed of 1.5 meters per second (3.4 miles per hour). If, however, you can demonstrate that the minimum wind speed at your site (measured at 10 meters) has been higher than 1.5 meters per second, or that the maximum atmosphere stability has always been less stable than class F, you may use the minimum wind speed and most stable atmospheric conditions at your site for the worst-case analysis. To demonstrate higher minimum wind speeds or less stable atmospheric conditions, you will need to document local meteorological data from

the previous three years that are applicable to your site. If you do not keep weather data for your site (most sources do not), you may call another nearby source, such as an airport, or a compiler, such as the National Weather Service, to determine wind speeds for your area. Exhibit 3-1 in Chapter 3 describes atmospheric stability classes in relation to wind speed and cloud cover. Your airport or other source will be able to give you information on cloud cover. A small difference in wind speed probably will not lead to a significant decrease in the distance to the endpoint.

EXHIBIT 4-3
REQUIRED PARAMETERS FOR MODELING WORST-CASE SCENARIOS

Endpoints
- For toxic substances, use the endpoint specified in part 68, Appendix A.
- For flammable substances, use the endpoint of an overpressure of 1 pound per square inch (psi) for vapor cloud explosions.

Wind speed/stability
- Use wind speed of 1.5 meters per second and F stability class unless you can demonstrate that local meteorological data applicable to the site show a higher minimum wind speed or less stable atmosphere at all times during the previous three years. If you can demonstrate a higher minimum wind speed or less stable atmosphere over three years, these minimums may be used.

Ambient temperature/humidity
- For toxic substances, use the highest daily maximum temperature during the past three years and average humidity for the site.

Height of release
- For toxic substances, assume a ground level release.

Topography
- Use urban or rural topography, as appropriate.

Dense or neutrally buoyant gases
- Tables or models used for dispersion of regulated toxic substances must appropriately account for gas density.

Temperature of released substance
- For liquids (other than gases liquefied by refrigeration), use the highest daily maximum temperature, based on data for the previous three years, or at process temperature, whichever is higher.
- Assume gases liquefied by refrigeration at atmospheric pressure are released at their boiling points.

Temperature and Humidity. For the worst-case release of a regulated toxic substance, you must assume the highest daily maximum temperature that occurred in the previous three years (the highest temperature reached in the last three years) and the average humidity for the site. If you have not kept information on temperature and humidity at your site, you may obtain it from a local meteorological station. EPA's *RMP Offsite Consequence Analysis Guidance* assumes a temperature of 25°C (77°F) and 50 percent humidity. If you use the EPA's guidance for your offsite consequence analysis, you may use these assumptions even if the actual highest temperature at your site is higher or lower. If the temperature at your site is significantly lower, EPA's guidance may give overly conservative results,

particularly for toxic liquids. Small differences in temperature and humidity are unlikely to have a major effect on results, however.

Topography. Two choices are provided for topography for the worst-case scenario. If your site is located in an area with few buildings or other obstructions, you should assume open (rural) conditions. If your site is in an urban location, or is in an area with many obstructions, you should assume urban conditions.

Gas or Vapor Density. For the worst-case analysis, you must use a model appropriate for the density of the released gas or vapor. Generally, for a substance that is lighter than air or has a density similar to that of air, you would use a model for neutrally buoyant vapors. The initial vapor density of a substance with respect to air can be estimated from its molecular weight, assuming air has a "molecular weight" of approximately 29. For a substance that is heavier than air (molecular weight greater than 29), you generally would use a dense gas model. There are cases where a dense gas model may be appropriate for a substance with molecular weight of 29 or less (e.g., release of a compressed gas as a cold vapor) or where a neutrally buoyant plume model may be appropriate for a substance with a higher molecular weight (e.g., release by slow evaporation, with considerable mixing with air). In addition, dense gases and vapors will become neutrally buoyant through mixing with air as they move downwind. If you can account for such conditions in modeling, you may do so.

ESTIMATING RELEASE RATES

Toxic Gases. Toxic gases include all regulated toxic substances that are gases at ambient temperature (temperature 25º C, 77º F). For the consequence analysis, the total quantity in the single largest vessel or process line is assumed to be released as a gas over a period of 10 minutes, except in the case of gases liquefied by refrigeration under atmospheric pressure. The release rate (per minute) for a gas (not liquefied by refrigeration) is the total quantity released divided by 10. Passive mitigation measures (e.g., enclosure) may be taken into account in the analysis of the worst-case scenario. A 10-minute release must be assumed for gases regardless of the model you use.

Gases liquefied by refrigeration alone (not under pressure) and released into diked areas may be modeled as liquids at their boiling points, if the pool formed by the released liquid would be greater than one centimeter (0.39 inches) in depth. In this case, you may assume the liquefied gas is released from a pool by evaporation at the boiling point of the gas. If the refrigerated liquefied gas is not contained by passive mitigation, or if the pool formed would have a depth of one centimeter or less, you must treat the released substance as a gas released over 10 minutes. EPA's analysis indicated that pools of gas liquefied by refrigeration with a depth of one centimeter or less would evaporate so rapidly at their boiling points that treatment as gaseous releases over 10 minutes is reasonable.

Toxic liquids. For toxic liquids, you must assume that the total quantity in a vessel is spilled, forming a pool. For toxic liquids carried in pipelines, you must assume that the largest quantity that might be released from the pipeline forms a pool. Passive mitigation systems (e.g., dikes) may be taken into account in consequence

analysis. You must assume that the total quantity spilled spreads instantaneously to a depth of one centimeter (0.39 inches) in an undiked area or covers a diked area instantaneously. You estimate the release rate to air as the rate of evaporation from the pool. To estimate the evaporation rate, you need to estimate the surface area of the pool. You can take into account the surface characteristics of the area into which the liquid would be spilled; for example, some models for pool evaporation will take into account the type of soil if the spill will take place in an unpaved area. Your modeling also should consider the length of time it will take for the pool to evaporate.

You may use any appropriate model to estimate the evaporation rate of a spilled regulated substance from a pool and estimate the air dispersion distance to the specified endpoint of the regulated substance. The release rate can then be used to estimate the distance to the endpoint.

ESTIMATING DISTANCE TO THE ENDPOINT

You may use any appropriate model, as discussed above, to estimate the distance to the endpoint specified in part 68 Appendix A for a release of a regulated toxic substance, using the required modeling assumptions.

WORST-CASE RELEASES OF FLAMMABLE SUBSTANCES

For the worst-case scenario involving a release of a regulated flammable substance (a flammable gas or volatile flammable liquid), you must assume that the quantity of the flammable substance is released into a vapor cloud and that a vapor cloud explosion results. You must estimate the distance to an endpoint to an overpressure level of 1 pound per square inch (psi) from the explosion of the vapor cloud.

- If the flammable substance is normally a gas at ambient temperature and handled as gas or liquid under pressure or if the flammable substance is a gas handled as a refrigerated liquid and is not contained when released or the contained pool is one centimeter or less deep, you must assume the total quantity is released as a gas and is involved in a vapor cloud explosion.

- If the flammable substance is a liquid or a refrigerated gas released into a containment area with a depth greater than one centimeter, you may assume that the quantity that volatilizes in 10 minutes is involved in a vapor cloud explosion.

As in the case of the worst-case release analysis for toxic substances, the worst-case distance to the endpoint for flammable substances is based on a number of very conservative assumptions. Release of the total quantity of a flammable substance in a vessel or pipe into a vapor cloud generally would be highly unlikely. Vapor cloud explosions are also unlikely events; in an actual release, the flammable gas or vapor released to air might disperse without ignition, or it might burn instead of exploding, with more limited consequences. The endpoint of 1 psi is intended to be conservative and protective; it does not define a level at which severe injuries or death would be commonly expected. An overpressure of 1 psi is unlikely to have serious direct effects on people; this overpressure may cause property damage such

as partial demolition of houses, which can result in injuries to people, and shattering of glass windows, which may cause skin laceration from flying glass.

To carry out the worst-case consequence analysis for flammable substances, you may use a TNT-equivalent model (i.e., a model that estimates the explosive effects of a flammable substance by comparison with the effects of an equivalent quantity of the high explosive trinitrotoluene (TNT), based on the available combustion energy in the vapor cloud - see *Guidelines for Evaluating the Characteristics of Vapor Cloud Explosions, Flash Fires, and BLEVEs* (1994) for additional information). Such models allow you to estimate the distance to a specific overpressure level, based on empirical data from TNT explosions. If you use a TNT-equivalent model, you must assume that 10 percent of the flammable vapor in the cloud participates in the explosion (i.e., you assume a 10 percent yield factor for the explosion). You do not have to use a TNT-equivalent model; other models are available that take into account more site-specific factors (e.g., degree of confinement of the vapor cloud). Generally, however, a TNT-equivalent model is the simplest to use.

NUMBER OF SCENARIOS

The number of worst-case scenarios you must analyze depends on several factors as discussed below. You only need to consider the hazard (toxicity or flammability) for which a substance is regulated (i.e., even if a regulated toxic substance is also flammable, you only need to consider toxicity in your analysis; even if a regulated flammable substance is also toxic, you only need to consider flammability).

PROGRAM 1 PROCESSES

To demonstrate that a process is eligible for Program 1 (see Chapter 2), you must conduct a worst-case release analysis for every toxic and flammable regulated substance held in that process above the applicable threshold quantities. For the process to be in Program 1, that analysis must show that the distance to the specified endpoint for every regulated substance in the process is smaller than the distance to any public receptor. If you have several processes that may qualify for Program 1, you will have to conduct worst-case analysis for each process to determine which qualify. You will need to report in the RMP the worst-case results with the greatest distance to an endpoint for those processes you determine to be eligible for Program 1.

If the distance to the endpoint in the worst-case analysis is equal to or greater than the distance to any public receptor, the process would be in Program 2 or Program 3 (discussed below). When you consider possible eligibility of your processes for Program 1, you may want to look particularly at processes containing only flammable substances, which are likely to have shorter worst-case distances than toxic substances.

PROGRAM 2 AND 3 PROCESSES

For all your Program 2 and 3 processes taken together, you must identify, carry out and report in the RMP one worst-case analysis for the regulated toxic substances and one worst-case analysis for the regulated flammable substances held above their

threshold quantities in those processes. The basic purpose of the worst-case analysis is to identify the geographical areas and the public receptors and population within those areas that could be affected by a worst-case release. The release that results in the greatest distance to an endpoint would affect the largest geographical area and the greatest number of public receptors and people, so as a general matter only that release (and not others affecting a smaller area) needs to be reported. The reported scenario for toxic substances must be the scenario estimated to result in the greatest distance to a toxic endpoint; for flammable substances, it must be the scenario estimated to lead to the greatest distance to 1 psi overpressure for a vapor cloud explosion. Additional worst-case analyses must be reported for toxic or flammable substances if a worst-case release from a different location at the facility potentially would affect a somewhat different geographical area containing public receptors and people in addition to those affected by the scenario giving the greatest distance.

IDENTIFYING THE "WORST" WORST-CASE SCENARIO

Toxics. To determine the scenario that gives the greatest distance to an endpoint for processes containing toxic substances, you may have to analyze more than one scenario, because the distances depend on more than simply the quantity in a process. For toxic liquids, for example, distances depend on the magnitude of the toxic endpoint, the molecular weight and volatility of the substance, and the temperature of the substance in the process, as well as quantity. A smaller quantity of a substance at an elevated temperature may give a greater distance to the endpoint than a larger quantity of the same substance at ambient temperature. In some cases, it may be difficult to predict which substance and process will give the greatest worst-case distance. You also may need to carry out analyses of worst-case scenarios for locations at significant distances from each other to determine whether different public receptors might be affected by releases.

Flammables. For flammable substances, the greatest quantity in a process is likely to give the greatest distance to the endpoint, but there may be variations, depending on heat of combustion and distance to the fence line. You may have to carry out several analyses to identify the scenario that gives the greatest distance to the endpoint. As in the case of toxic substances, you also may need to carry out analyses for locations far apart from each other to determine whether different geographical areas and thus public receptors might be affected.

For both toxic and flammable substances, the worst-case distances should be considered only approximations.

QS & AS
WORST-CASE AND MITIGATION

Q. At my facility, if the worst-case release scenarios for regulated toxic substances and the worst-case scenario for regulated flammable substances involve the same process, must I analyze both?

A. Yes. If the worst-case release scenarios for regulated toxic substances and regulated flammable substances in Program 2 and 3 processes are associated with the same process, the two worst-case release scenarios must be analyzed separately.

Q. What measures qualify as "passive mitigation"?

A. Passive mitigation is defined in § 68.3 as "equipment, devices, or technologies that function without human, mechanical, or other energy input." Passive mitigation systems include building enclosures, dikes, and containment walls. Measures such as fire sprinkler systems, water curtains, valves, scrubbers, or flares would not be considered passive mitigation because they require human, mechanical, or energy input to function.

Q. When analyzing the worst-case scenario for regulated toxic substances, must I anticipate a specific cause (e.g., fire, explosion, etc.) of the scenario?

A. No. The worst-case analysis for a release of regulated toxic substances must conform to specific assumptions as identified in § 68.25(c) and (d). Anticipated causes of the release will not affect the analysis, and are not required. A specific cause may be considered in analyzing the alternative release scenarios although it is not a requirement.

Q. Would all of the regulated substances stored in a salt dome be assumed to be released in the worst-case scenario?

A. The worst case scenario for salt domes would be examined in a manner similar to that for underground storage tanks. Reservoirs or vessels sufficiently buried underground are passively mitigated or prevented from failing catastrophically. You should evaluate the failure of piping connected to underground storage for the worst-case and alternative scenarios.

Q. Are valves in piping considered administrative controls?

A. No, administrative controls are written procedures that limit the quantity stored or flowing through the pipes. Valves are considered active mitigation systems.

4.3 ALTERNATIVE RELEASE SCENARIOS

There are only a few required assumptions for the alternative scenario analysis. Exhibit 4-4 summarizes the required assumptions.

EXHIBIT 4-4
REQUIRED PARAMETERS FOR MODELING ALTERNATIVE SCENARIOS

Endpoints

- For toxic substances, use the endpoints specified in part 68, Appendix A.
- For flammable substances, use as the endpoints:
  - Overpressure of 1 pound per square inch (psi) for vapor cloud explosions,
  - Radiant heat of 5 kilowatts per square meter (kW/m^2) (or equivalent dose) for fireballs or pool fires, or
  - Lower flammability limit (LFL) for vapor cloud fires.

Wind speed/stability

- Use typical meteorological conditions at your site.

Ambient temperature/humidity

- Use average temperature/humidity data gathered at your site or at a local meteorological station.

Height of release

- Release height may be determined by the release scenario.

Topography

- Use urban or rural topography, as appropriate.

Dense or neutrally buoyant gases

- Tables or models used for dispersion of regulated toxic substances must appropriately account for gas density.

Temperature of released substance

- Substances may be considered to be released at a process or ambient temperature that is appropriate for the scenario.

ACCEPTABLE ALTERNATIVE SCENARIOS

Your alternative scenario for a covered Program 2 or 3 process must be one that is more likely to occur than the worst-case scenario and that reaches an endpoint offsite, unless no such scenario exists. You do not need to demonstrate greater likelihood of occurrence or carry out any analysis of probability of occurrence; you only need to use reasonable judgement and knowledge of the process. If, using a combination of reasonable assumptions, modeling of a release of a regulated substance from a process shows that the relevant endpoint is not reached offsite, you can use the modeling results to demonstrate that a scenario does not exist for the process that will give an endpoint offsite. Even in that instance, you still must report an alternative scenario (i.e., one with an onsite endpoint) for Program 2 and 3 processes. Alternative scenarios are not required for Program 1 processes.

Release scenarios you should consider include, but are not limited to, the following, where applicable:

- Transfer hose releases due to splits or sudden uncoupling;
- Process piping releases from failures at flanges, joints, welds, valves and valve seals, and drains or bleeds;
- Process vessel or pump releases due to cracks, seal failure, drain bleed, or plug failure;
- Vessel overfilling and spill, or overpressurization and venting through relief valves or rupture disks; and
- Shipping container mishandling and breakage or puncturing leading to a spill.

For alternative release scenarios, you may consider active mitigation systems, such as interlocks, shutdown systems, pressure relieving devices, flares, emergency isolation systems, and fire water and deluge systems, as well as passive mitigation systems. Mitigation systems considered must be capable of withstanding the event that triggers the release while remaining functional.

You should consider your five-year accident history and failure scenarios identified in your hazard review or process hazards analysis in selecting alternative release scenarios for regulated toxic or flammable substances (e.g., you might choose an actual event from your accident history as the basis of your scenario). You also may consider any other reasonable scenarios.

The alternative scenarios you choose to analyze should be scenarios that you consider possible at your site. Although EPA requires no explanation of your choice of scenario, you should choose a scenario that you think you can explain to emergency responders and the public as a reasonable alternative to the worst-case scenario. For example, you could pick a scenario based on an actual event, or you could choose a scenario that you worry about, because circumstances at your site make it a possibility. If you believe that there is no reasonable scenario that could lead to offsite consequences, you may use a scenario that has no offsite impacts for your alternative analysis. You should be prepared to explain your choice of such a scenario to the public (as well as to the implementing agency), should questions arise.

ALTERNATIVE RELEASES OF TOXIC SUBSTANCES

To estimate distances to the endpoint for alternative releases of toxic substances, you need to identify reasonable scenarios for the regulated substances in covered processes at your site and model these scenarios using appropriate models. As noted above, for alternative release scenarios, you are permitted to take credit for both passive and active mitigation systems, if both are in place. Modeling alternative releases of toxic substances is discussed below.

Although alternative scenarios are intended to be more likely than worst-case scenarios, the analysis of alternative scenarios should not be expected to provide realistic estimates of areas in which the public might be endangered in case of a release. The same conservative, protective endpoints are used for alternative release analysis as for worst-case analysis. These endpoints are intended to represent exposure levels below which most members of the public will not suffer any serious health effects. The endpoints are based on exposures for longer periods than may be likely in an actual release. In addition, modeling carried out to estimate distances to these endpoints, even when based on more realistic assumptions than used for the worst-case modeling, likely will provide results with a high degree of uncertainty. These estimated distances should not be considered a necessarily accurate prediction of the results of an actual release.

MODELING ASSUMPTIONS

Quantity. EPA has not specified any assumptions you must make concerning quantity released for an alternative release scenario. You could consider any site-specific factors in developing a reasonable estimate of quantity released (e.g., the quantity that could be released from a sheared pipe in the time it would take to shut off flow to the pipe).

Release Height. You may assume any appropriate release height for your alternative scenarios. For example, you may analyze a scenario in which a regulated substance would be released at a height well above ground level.

Wind Speed and Atmospheric Stability. You should use typical meteorological conditions at your site to model alternative scenarios. To determine typical conditions, you may need to obtain local meteorological data that are applicable to your site. If you do not keep weather data for your site (most sources do not), you may call another nearby source, such as an airport, or a compiler, such as the National Weather Service, to determine wind speeds for your area. Your airport or other source will be able to give you information on cloud cover.

ESTIMATING RELEASE RATES

Toxic Gases. To estimate a release rate for toxic gases, you may make any appropriate assumptions based on conditions at your site and use any appropriate model. EPA's *RMP Offsite Consequence Analysis Guidance* provides a simple equation and chemical-specific data for estimating the release rate of a gas from a hole in a vessel or pipe based on hole size, tank pressure, and chemical properties. The size of the hole might be estimated from, for example, the hole size that would result from shearing off a valve or pipe from a vessel.

Tank or pipe damage or failure resulting in the release of a gas liquefied under pressure might be an appropriate alternative scenario at some sites. If such a release would be possible at your site, you may need to consider a model or method that will deal with this type of scenario.

You also should consider the duration of the release. EPA does not require you to assume any specific time period for the release. You could estimate the release

duration based on the length of time it would take to stop the release, or you could estimate a maximum duration based on a calculated release rate and the quantity in the tank or pipes. If you estimate that a release of toxic gas would be stopped very quickly, resulting in a "puff" rather than a plume, you may want to use a model that deals with puff releases. EPA's *RMP Offsite Consequence Analysis Guidance* is not appropriate for estimating distance to an endpoint for puff releases. EPA provides information on various other models, including those suitable for analysis of puff releases, at the Support Center for Regulatory Air Models: http://www.epa.gov/scram001//.

You may consider both passive and active mitigation in estimating release rates. For gases, passive mitigation may include enclosed spaces. Active mitigation for gases may include an assortment of techniques including automatic shutoff valves, rapid transfer systems (emergency drainage), and water/chemical sprays. These mitigation techniques have the effect of reducing either the release rate or the duration of the release, or both. EPA's *RMP Offsite Consequence Analysis Guidance* includes methods of accounting for mitigation. You also may use your knowledge or other methods to account for mitigation.

Toxic liquids. For alternative releases of toxic liquids, you may consider any scenario that would be reasonable for your site. For alternative release scenarios, you are permitted to take credit for both passive and active mitigation systems, or a combination if both are in place. For liquids, passive mitigation may include techniques such as dikes and trenches. Active mitigation for liquids may include an assortment of techniques including automatic shutoff valves, emergency drainage, foam or tarp coverings, and water or chemical sprays. These mitigation techniques have the effect of reducing either the quantity released into the pool or the evaporation rate from the pool. EPA's *RMP Offsite Consequence Analysis Guidance* discusses some methods of accounting for mitigation.

ESTIMATING DISTANCE TO THE ENDPOINT

For alternative releases, you may use any appropriate model (as discussed in 4.1) to estimate the distance to the specified endpoint for an alternative release of a regulated toxic substance. You may use site-specific conditions, including typical weather conditions, and consider any site-specific factors appropriate to your scenario. You must use the endpoints specified in part 68 Appendix A, as for the worst-case analysis.

ALTERNATIVE RELEASES OF FLAMMABLE SUBSTANCES

Alternative release scenarios for flammable substances are somewhat more complicated than for toxic substances because the consequences of a release and the endpoint of concern may vary. For the worst case, the consequence of concern is a vapor cloud explosion, with an overpressure endpoint. For alternative scenarios involving fires rather than explosions, other endpoints than overpressure (e.g., heat radiation) may need to be considered. The rule specifies endpoints for fires based on the heat radiation level that may cause second degree burns from a 40-second exposure and the lower flammability limit (LFL), which is the lowest concentration

in air at which a substance will burn. Some possible scenarios involving flammable substances are discussed below.

- **Vapor cloud fires** (flash fires) may result from dispersion of a cloud of flammable vapor and ignition of the cloud following dispersion. Such a fire could flash back and could represent a severe heat radiation hazard to anyone in the area of the cloud. Vapor cloud fires may be modeled using air dispersion modeling techniques to estimate distances to a concentration equal to the LFL.

- A **pool fire**, with potential radiant heat effects, may result from a spill of a flammable liquid. The endpoint for this type of fire, as listed in the rule, is a radiant heat level of 5 kilowatts per square meter (kW/m2) for 40 seconds; a 40-second exposure to this heat level could cause second degree burns.

- A **boiling liquid, expanding vapor explosion (BLEVE)**, leading to a fireball that may produce intense heat, may occur if a vessel containing flammable material ruptures explosively as a result of exposure to fire. Heat radiation from the fireball is the primary hazard; vessel fragments and overpressure from the explosion also can result. BLEVEs are generally considered unlikely events; however, if you think a BLEVE is possible at your site, you should estimate the distance at which radiant heat effects might lead to second degree burns, since that is the effect of concern underlying the rule's endpoint for fires. The point of offsite consequence analyses is to determine how far away from the point of release effects of concern could occur, so you should estimate the distance for BLEVEs even though one would not last for 40 seconds. For BLEVEs, you would need to estimate the radiant heat level at which exposure for the duration of the BLEVE would cause second degree burns. You then would need to estimate the distance to that heat level. You also may want to consider models or calculation methods to estimate effects of vessel fragmentation, although you are not required to analyze such effects.

- For a **vapor cloud explosion** to occur, rapid release of a large quantity of flammable material, turbulent conditions (caused by a turbulent release or congested conditions in the area of the release, or both), and other factors are generally necessary. Vapor cloud explosions generally are considered unlikely events; however, if conditions at your site are conducive to vapor cloud explosions, you may want to consider a vapor cloud explosion as an alternative scenario. The 1 psi overpressure endpoint still applies to a vapor cloud explosion for purposes of analyzing an alternative scenario, but you could use less conservative assumptions than for the worst-case analysis, including any reasonable estimate of the quantity in the cloud and the yield factor. A vapor cloud deflagration, involving lower flame speeds than a detonation and resulting in less damaging blast effects, is more likely than a detonation. You may assume a vapor cloud deflagration for the alternative scenario, if you think it is appropriate, and use the radiant heat endpoint (adjusted for duration).

- A **jet fire** may result from the puncture or rupture of a tank or pipeline containing a compressed or liquefied gas under pressure. The gas can form a jet that discharges into the air in the direction of the hole; the jet then may ignite. Jet fires could contribute to BLEVEs and fireballs if they impinge on tanks of flammable substances. A large horizontal jet fire may have the potential to pose an offsite hazard. You may want to consider a jet fire as an alternative scenario, if appropriate for your site.

MODELING ASSUMPTIONS

Quantity. EPA has not specified any assumptions you must make concerning quantity released for alternative scenario analysis for flammable substances. You may consider any site-specific factors in developing a reasonable estimate of quantity released, as for toxic substances (e.g., the quantity that could be released from a ruptured pipe in the time it would take to shut off flow to the pipe).

Release Height. You may assume any appropriate release height for your alternative scenarios for flammable substances.

Wind Speed and Atmospheric Stability. Meteorological conditions may have little effect on some scenarios for flammable substances (e.g., vapor cloud explosions and BLEVEs), but may have a relatively large effect on others (e.g., a vapor cloud fire resulting from downwind dispersion of a vapor cloud and subsequent ignition). You should use typical meteorological conditions at your site to model appropriate alternative scenarios. To determine typical conditions, you may need to obtain local meteorological data that are applicable to your site, as discussed above.

ESTIMATING RELEASE RATES

Flammable Gases. To estimate a release rate for flammable gases, you may make any appropriate assumptions based on conditions at your site. You may consider the effects of both passive and active mitigation systems. The methods provided in EPA's *RMP Offsite Consequence Analysis Guidance* for rate of release of a gas from a hole in a vessel or pipe for toxic gases also can be used for flammable gases. Chemical-specific data are provided for flammable gases, to be used along with hole size and tank pressure to estimate release rates.

Flammable liquids. For alternative releases of flammable liquids, you may consider any scenario that would be reasonable for your site. You are permitted to take credit for both passive and active mitigation systems, or a combination if both are in place, as for toxic liquids. You could consider release of the liquid into a pool and release to air by pool evaporation, if you consider this to be a reasonable scenario.

If evaporation of a flammable liquid from a pool is an appropriate assumption for your alternative scenario, you can use any scientifically appropriate method to estimate the evaporation rate.

ESTIMATING DISTANCE TO THE ENDPOINT

You may use any appropriate model to estimate the distance to the specified endpoint for alternative scenarios for regulated flammable substances. Several possible consequences of releases of flammable substances are discussed below.

Vapor cloud fire. You may use any appropriate model to estimate distances for a vapor cloud fire. The LFL endpoint, specified in the rule, would be appropriate for vapor cloud fires. You may use air dispersion modeling to estimate the maximum distance to the LFL. You may want to consider, however, whether it is likely that a flammable gas or vapor could disperse to the maximum distance to the LFL before reaching an ignition source. The actual dispersion distance before ignition might be much shorter than the maximum possible distance.

Pool fire. Any appropriate model may be used for pool fires of flammable liquids. The applicable endpoint specified in the rule is the heat radiation level of 5 kW/m^2.

BLEVE. If a fireball from a BLEVE is a potential release scenario at your site, you may use any model or calculation method to estimate the distance to a radiant heat level that can cause second degree burns (a heat "dose" equivalent to the specified radiant heat endpoint of 5 kW/m^2 for 40 seconds).

Vapor cloud explosion. If you have the potential at your site for the rapid release of a large quantity of a flammable vapor, particularly into a congested area, a vapor cloud explosion may be an appropriate alternative release scenario. For the alternative analysis, you may estimate any reasonable quantity of flammable substance in the vapor cloud. The endpoint for vapor cloud explosions is 1 psi, as for the worst case; however, a smaller yield factor may be used for the alternative scenario analysis.

NUMBER OF SCENARIOS

You are required to analyze at least one alternative release scenario for each listed toxic substance you have in a Program 2 or Program 3 process above its threshold quantity. If you have the same substance above the threshold in several processes or locations, you need only analyze one alternative scenario for it. You also are required to analyze one alternative release scenario representing all regulated flammable substances in Program 2 or 3 processes; you do not need to analyze an alternative scenario for each flammable substance above the threshold. For example, if you have five listed substances — chlorine, ammonia, hydrogen chloride, propylene, and acetylene — above the threshold in Program 2 or 3 processes, you will need to analyze one alternative scenario each for chlorine, ammonia, and hydrogen chloride (toxics) and a single alternative scenario to cover propylene and acetylene (flammable substances).

No alternative scenario analysis is required for regulated substances in Program 1 processes. If worst-case scenario analysis for a process shows no public receptors within the distance(s) to the applicable endpoint(s), and the process meets the other Program 1 criteria, you do not have to carry out an alternative scenario analysis for the process.

In addition, no alternative scenario analysis is required for any process that does not contain more than a threshold quantity of a regulated substance, even if you believe such a process is a likely source of a release.

4.4 ESTIMATING OFFSITE RECEPTORS

The rule requires that you include in your RMP an estimate of the residential populations within the geographical areas that could be affected by the hypothetical worst-case or alternative releases you have analyzed. The geographical area is the area within the circle defined by the endpoint for your worst-case and alternative release scenarios (i.e., the center of the circle is the point of release and the radius is the distance to the endpoint). In addition, you must report in the RMP whether certain types of public receptors and environmental receptors are within the circles.

RESIDENTIAL POPULATIONS

To estimate residential populations, you may use the most recent Census data or any other source of data that you believe is more accurate. You are not required to update Census data or conduct any surveys to develop your estimates. Census data are available in public libraries and in the LandView system, which is available on DVD (see box below). The rule requires that you estimate populations to two significant digits. For example, if there are 1,260 people within the circle, you may report 1,300 people. If the number of people is between 10 and 100, estimate to the nearest 10. If the number of people is less than 10, provide the actual number.

Census data are presented by Census tract. If your circle covers only a portion of the tract, you should develop an estimate for that portion. The easiest way to do this is to determine the population density per square mile (total population of the Census tract divided by the number of square miles in the tract) and apply that density figure to the number of square miles within your circle. Because there is likely to be considerable variation in actual densities within a Census tract, this number will be approximate. The rule, however, does not require you to correct the number.

OTHER PUBLIC RECEPTORS

Other public receptors must be noted in the RMP (see the discussion of public receptors in Chapter 2). If there are any schools, residences, hospitals, prisons, public recreational areas or arenas, or commercial or industrial areas within the circle, you must report that. You are not required to develop a list of all public receptors; you must simply check off that one or more such areas is within the circle. Most receptors can be identified from local street maps.

ENVIRONMENTAL RECEPTORS

Environmental receptors are defined as natural areas such as national or state parks, forests, or monuments; officially designated wildlife sanctuaries, preserves, refuges, or areas; and Federal wilderness areas. Only environmental receptors that can be identified on local U.S. Geological Survey (USGS) maps (see box below) need to be considered. You are not required to locate each of these specifically. You are only required to check off in the RMP which specific types of areas are within the circle.

If any part of one of these receptors is within your circle, you must note that in the RMP.

Important: The rule does not require you to assess the likelihood, type, or severity of potential impacts on either public or environmental receptors. Identifying them as within the circle simply indicates that they could be adversely affected by the release.

HOW TO OBTAIN CENSUS DATA AND LANDVIEW®

Census data can be found in publications of the Bureau of the Census, available in public libraries, including *County and City Data Book.*

LandView ® is a desktop mapping system that includes database extracts from EPA, the Bureau of the Census, the U.S. Geological Survey. These databases are presented in a geographic context on maps that show jurisdictional boundaries, detailed networks of roads, rivers, and railroads, census block group and tract polygons, schools, hospitals, churches, cemeteries, airports, dams, and other landmark features. LandView lets you determine the population within any radius, anywhere in the U.S.

For PC and Mac. $129 for 2 DVD set, covers entire country

U.S. Department of Commerce
Bureau of the Census
P.O. Box 277943
Atlanta, GA 30384-7943
Phone: (301) 763-INFO (4636) (Customer Services -- orders)
Phone: (301) 763-1128 (Geography Staff -- content)
http://www.census.gov/geo/landview/

Further information on Census data is available at the Bureau of the Census web site at www.census.gov.

HOW TO OBTAIN USGS MAPS

The production of digital cartographic data and graphic maps comprises the largest component of the USGS National Mapping Program. The USGS's most familiar product is the 1:24,000-scale Topographic Quadrangle Map. This is the primary scale of data produced, and depicts greater detail for a smaller area than intermediate-scale (1:50,000 and 1:100,000) and small-scale (1:250,000, 1:2,000,000 or smaller) products, which show selectively less detail for larger areas.

To order maps, publications, and other miscellaneous products on paper and compact disc media from the USGS by mail, send your order form and payment to:

USGS Information Services
Box 25286
Denver, CO 80225

By fax, call 303-202-4693 and transmit the order form.

To order digital maps, digital cartographic and geographic data, aerial photographs, and satellite imagery products from the USGS by mail, send your order form and payment to:
USGS EROS Data Center
47914 252nd Street
Sioux Falls, SD 57198

By fax, call 605-594-6589 and transmit the order form.

Online, submit your order through the USGS on-line ordering site, The USGS Store at:
http://store.usgs.gov/

For more information, visit the USGS Earth Science Information Center on the Internet at http://ask.usgs.gov, or for ordering assistance, call 1-888-ASK-USGS. For additional information, contact any USGS Earth Science Information Center or call 1-800-USA-MAPS.

Qs and As
OFFSITE CONSEQUENCE ANALYSIS

Q. How close must a stationary source be to a weather station for that station's data to be applicable to the stationary source?

A. EPA has not set specific distance limits, but will allow owners and operators to use reasonable judgement in determining whether data from a weather station is applicable to the stationary source. Factors such as topography and distance between the stationary source and a weather station should be taken into consideration when evaluating the applicability of the weather station's data to the stationary source.

Q. Must air dispersion models that are used to analyze worst-case release scenarios be able to account for multiple vessels and how those vessels could impact one another in the event of an accidental release?

A. No. Models used for worst-case release scenario analysis do not need to consider compounding effects of accidental releases from multiple vessels because worst-case release is defined by the rule as a single vessel or process line failure that will result in the greatest distance to an endpoint.

Q. If the estimated population changes, would the RMP have to be updated?

A. No. Changes in U.S. Census data do not necessitate a correction or update of the RMP. However, all updates to the RMP should use the most recent U.S. Census data.

Q. What if a flammable event has a different time duration than the 5 kw/m^2 for 40 seconds?

A. EPA recognizes that flammable events may occur for a different amount of exposure time. Therefore, the owner or operator should determine the distance to an equivalent exposure - e.g. if the flammable event occurs for 20 seconds, determine the distance to an equivalent exposure level.

Q. Could positive buoyancy models be used?

A. Yes, provided there is a basis for use and the owner or operator explains the rationale for use of positive buoyancy models.

4.5 Examples of Worst Case Scenarios

EXAMPLE ▸ SOURCE A

Source A, a retail operation that supplies ammonia, has one covered process: a 200-ton ammonia storage tank. Source A carries out worst-case consequence analyses for this process, with the following results: For 400,000 pounds of anhydrous ammonia, the distance to the specified endpoint (0.14 mg/L) is estimated as more than 10 miles.

Residences and a business center are located within 0.15 miles of the facility; therefore the regulated process is not eligible for Program 1. Source A must report the results of the worst-case analysis in the RMP.

EXAMPLE ▸ SOURCE B

Source B is a medium-sized metal products manufacturer with two processes containing regulated toxic substances above their thresholds: a tank storing 50,000 pounds of 37 percent hydrochloric acid for use in plating processes and five interconnected, one-ton tanks of chlorine used in a wastewater treatment plant. Only one worst-case analysis is required for toxic substances for Program 2 and Program 3 processes; because of the greater toxicity and volatility of chlorine, Source B expects that a worst-case release of chlorine would result in the greatest distance to the endpoint. Source B does not believe the hydrochloric acid process would be eligible for Program 1 because of the proximity of public receptors (including workers at an adjacent industrial facility), and, therefore, only carries out the worst-case analysis for the chlorine process. A distance of 2.80 miles to the endpoint is estimated for a release of 2,000 pounds of chlorine. Since there are public receptors within that distance, Source B must report this worst-case analysis in the RMP.

EXAMPLE ▸ SOURCE C

Source C is an inorganic chemical manufacturer with two covered processes: a tank containing 10 tons of 70 percent hydrofluoric acid solution and ten one-ton tanks of chlorine on a rack for wastewater treatment. Source C must carry out one worst-case analysis for regulated toxic substances for Program 2 and Program 3 processes. Because the toxic endpoint of chlorine is lower than that of hydrofluoric acid, and because the release rate will probably be greater for a gas than a solution, Source C decides to carry out the analysis for chlorine as the required worst-case analysis for toxic substances. Source C believes the hydrofluoric acid process may be eligible for Program 1 and, therefore, decides to do a worst-case analysis for this process as well. Results of the worst-case analyses for these two processes are:

- 2.80 miles for 2,000 pounds of chlorine
- 1 mile for 20,000 pounds of 70 percent hydrofluoric acid (released in a diked area)

Homes and businesses are located less than a mile from either process; therefore, neither process is eligible for Program 1. Source C must report the results of the worst-case analyses for chlorine.

EXAMPLE ▸ SOURCE D

Source D is a large chemical manufacturer with 11 regulated substances above their threshold quantities, including three flammable substances and eight toxic substances. The processes containing flammable substances are: three 18,000-gallon tanks containing 26,000 pounds of ethylene, 66,000 pounds of propylene, and 65,000 pounds of propane; the propane, however, is used as a fuel and is not subject to the rule. The largest quantities of toxic substances in processes are: 25,000 pounds of toluene diisocyanate (TDI), 100,000 pounds of chloroform, 25,000 pounds of anhydrous hydrogen chloride, 20,000 pounds of chlorine, 80,000 pounds of epichlorohydrin, 100,000 pounds of methyl chloride, 10,000 pounds of hydrogen cyanide, and 1,000 pounds of phosgene. For the RMP, Source D has to report one worst-case analysis for flammable substances and one for toxic substances; however, Source D believes the processes containing flammable substances may be eligible for Program 1 and, therefore, chooses to carry out a worst-case analysis for each of these processes. In addition, Source D believes the processes containing TDI and chloroform may be eligible for Program 1, because of the low volatility of TDI and the relatively low toxicity of chloroform, and decides to carry out analyses to determine eligibility. Source D is not sure which of the other processes containing toxic substances will give the greatest distance to the endpoint; therefore, it conducts screening analyses for all these processes. The worst-case distances for vapor cloud explosions of the flammable substances are:

- 0.24 miles for 26,000 pounds of ethylene;
- 0.32 miles for 66,000 pounds of propylene.

The worst-case distances to the endpoints for the toxic substances are:

- 0.06 miles for 25,000 pounds of TDI;
- 0.49 miles for 100,000 pounds of chloroform;
- 4.8 miles for 25,000 pounds of hydrogen chloride;
- 10 miles for 20,000 pounds of chlorine;
- 2.2 miles for 80,000 pounds of epichlorohydrin;
- 2.0 miles for 100,000 pounds of methyl chloride;
- 5.2 miles for 10,000 pounds of hydrogen cyanide; and
- 11 miles for 1,000 pounds of phosgene.

The processes containing ethylene and propylene are located 500 yards (0.28 miles) from a river (0.5 miles wide). The distance to the endpoint for these two processes does not extend beyond the river, which is not a recreational area; the processes are eligible for Program 1 (having met the other criteria). The distances to the endpoint for the TDI process do not reach public receptors in any direction; therefore, this process is also eligible for Program 1.

Source D reports the worst-case analysis results for ethylene, propylene, and TDI to demonstrate eligibility for Program 1. Since propylene was the "worst" worst-case scenario for all regulated flammables at the facility, the source does not have to report any other worst-case scenario results for flammable substances. The source does report the results for phosgene as the required worst-case analysis for toxic substances.

4.6 Examples of Alternative Releases

EXAMPLE ▸ SOURCE A

Source A, a retail operation that supplies ammonia and propane, has one covered process: an ammonia storage tank containing 400,000 pounds of anhydrous ammonia (a regulated toxic substance). The worst-case consequence analyses for this process indicated it is not eligible for Program 1. Source A must carry out and report an alternative scenario analysis for the process. Any reasonable and defensible scenarios can be analyzed for the process, provided they are more likely than the worst-case scenario and reach an off-site endpoint (unless no such scenario exists). The source must be able to explain its choice of scenarios.

EXAMPLE ▸ SOURCE B

Source B is a medium-sized metal products manufacturer with two covered processes containing regulated toxic substances: a chlorine wastewater treatment plant with 10,000 pounds of chlorine and a tank containing 50,000 pounds of 37 percent hydrochloric acid. Because of the proximity of public receptors, neither of these processes is eligible for Program 1. Source B must carry out and report an alternative scenario analysis for each of the two regulated substances. Source B may analyze any scenarios that are reasonable for the site and processes, provided they are more likely than the worst-case scenario and reach an off-site endpoint (unless no such scenario exists). The source must be able to explain its choice of scenarios.

EXAMPLE ▸ SOURCE C

Source C is an inorganic chemical manufacturer with two covered processes, one containing 20,000 pounds of chlorine and the other containing 20,000 pounds of 70 percent hydrofluoric acid. Source C's worst-case analyses indicated that these processes are not eligible for Program 1. Source C must carry out and report an alternative scenario analysis for each of these substances. The scenarios must be more likely than the worst-case scenario and reach an off-site endpoint (unless no such scenario exists). Within these constraints, the scenarios may be developed based on any reasonable and defensible assumptions. The source must be able to explain its choice of scenarios.

EXAMPLE ▸ SOURCE D

Source D is a large chemical manufacturer with covered processes containing two regulated flammable substances and eight regulated toxic substances. The worst-case analyses showed that the processes containing the flammable substances (ethylene and propylene) are eligible for Program 1. For flammable substances, Source D need not carry out and report an alternative scenario analysis.

The worst-case analyses showed that the process containing 25,000 pounds of the toxic substance toluene diisocyanate (TDI) also is eligible for Program 1; therefore, Source D does not need to carry out an alternative scenario analysis for TDI. Source D must carry out and report an alternative scenario analysis for each regulated toxic substance in a covered non-Program 1 process; thus, scenarios must be developed and analyzed for hydrogen chloride, chlorine, epichlorohydrin, methyl chloride, hydrogen cyanide, chloroform, and phosgene. If the substances are found in more than one vessel, the analysis should be conducted with respect to the vessel that presents the greatest relative risk of a release. Analyses of each vessel are not needed. Source D can develop any reasonable scenarios for these substances that are more likely than the worst-case scenario and reach an off-site endpoint (unless no such scenario exists), and must be able to explain its choice of scenario.

CHAPTER 5: MANAGEMENT SYSTEM

5.1 GENERAL INFORMATION (§68.15)

If you have at least one Program 2 or Program 3 process (see Chapter 2 for guidance on determining the Program levels of your processes), the management system provision in § 68.15 requires you to:

Develop a management system to oversee the implementation of the risk management program elements;

Designate a qualified person or position with the overall responsibility for the development, implementation, and integration of the risk management program elements; and

Document the names of people or positions and define the lines of authority through an organizational chart or other similar document, if you assign responsibility for implementing individual requirements of the risk management program to people or positions other than the person or position with overall responsibility for the risk management program.

ABOUT THE MANAGEMENT SYSTEM PROVISION

Management commitment to process safety is a critical element of any facility's risk management program. Since the program requires ongoing implementation of accident prevention and emergency response measures, management commitment does not end when the risk management plan is submitted to EPA. For process safety to be a constant priority, facility personnel must remain committed to every element of the risk management program.

By satisfying the requirements of this provision, you are ensuring that:

> The risk management program elements are integrated and implemented on an ongoing basis; and
>
> All groups within a source understand the lines of responsibility and communication.

5.2 HOW TO MEET THE MANAGEMENT SYSTEM REQUIREMENTS

Sources covered by this rule are diverse, so you are in the best position to decide how to appropriately implement the risk management program elements at your facility. Therefore, the rule provides considerable flexibility in complying with its program requirements.

WHAT DOES THIS MEAN FOR ME AS A SMALL FACILITY?

As a small facility that must comply with this provision, you most likely have one or two Program 2 or 3 processes. To begin, you may identify either the qualified person or position with overall responsibility for implementing the risk management program elements at your facility. As a small facility, it may make sense and be

practical to identify the name of the qualified person, rather than the position. Recognize that the only element of your management system that you must report in the RMP is the name of the qualified person or position with overall responsibility. Further, changes to this data element in your RMP do not trigger a special update of your RMP (although such changes must be reflected in RMP updates submitted for other reasons - see Chapter 9 for more information on RMP updates).

Identification of a qualified individual or position with overall responsibility may be all you need to do if the person or position named directly oversees the employees operating and maintaining the processes. You must define the lines of authority with an organizational chart or similar document only if you choose to assign responsibility for specific elements of the risk management program to persons or positions other than the person with overall responsibility. For a small facility, with few employees, it is likely that you will meet the requirements of this provision by identifying the one person or position with the overall responsibility of implementing the risk management program elements. If this is the case, you need not develop an organizational chart.

Even if you meet the requirements of this section by naming a single person or position, it is important to recognize that the person or position assigned the responsibility of overseeing implementation must have the ability and resources to ensure that your facility and employees carry out the risk management program, particularly the prevention elements, on an continuing basis. Key to the effectiveness of the rule is integrated management of the program elements.

WHAT DOES THIS MEAN FOR ME AS A MEDIUM OR LARGE FACILITY?

As a medium or large facility you may have more personnel turnover than smaller sites. For this reason, it may make more sense at your facility to identify a position, rather than the name of the specific person, with overall responsibility for the risk management program elements. Remember that the only element of your management system that you must report in the RMP is the name of the qualified person or position with overall responsibility. Also note that changes to this data element in your RMP do not require you to update your RMP.

As a relatively large or complex facility, you may choose to identify several people or positions to supervise the implementation of the various elements of the program; therefore, you must define the lines of authority through an organizational chart or similar document. Further, most large facilities already have likely developed and maintained some type of documentation defining positions and responsibilities. Any internal documents you currently have should be the starting point for defining the lines of authority at your facility. You may find that you can simply use or update current documents to satisfy this part of the management system provision. Exhibit 5-1 provides a sample of another type of documentation you may use in addition to or as a replacement for an organization chart.

Defining the lines of authority and roles and responsibilities of staff that oversee the risk management program elements will help to:

- Ensure effective communication about process changes between divisions;

Clarify the roles and responsibilities related to process safety issues at your facility;

Avoid problems or conflicts among the various people responsible for implementing elements of the risk management program;

Avoid confusion and allow those responsible for implementation to work together as a team; and

Ensure that the program elements are integrated into an ongoing approach to identifying hazards and managing risks.

Remember that all of the positions you identify in your documentation will report their progress to the person with overall responsibility for the program. However, nothing in the risk management program rule prohibits you from satisfying the management provision by assigning process safety committees with management responsibility, provided that an organizational chart or similar document identifies the names or positions and lines of authority.

EXHIBIT 5-1
SAMPLE MANAGEMENT DOCUMENTATION

Position	Primary Responsibility	Changes	Responsibility re: Changes
Operations Manager	Developing OPs Oversight of operation On-the-job training On-the-job competency testing Process Safety Information Selecting participants for PHAs, incident investigations Develop management of change and pre-startup procedures	New Equipment New Process Chemistry New Process Parameters New Procedures Change in Process Utilization	Inform head of training Inform head of maintenance Inform lead for PHAs Inform hazmat team as needed Inform contractors
Training Supervisor	Develop, track, oversee operator training program Track competency testing Set up and track operator refresher training Set up training for maintenance Work with contractors	New Equipment New Process Chemistry New Process Parameters New Procedures Change in Process Utilization New regulatory requirements	Revise training and refresher training courses Revise maintenance courses, as needed Inform other leads of need for additional training
Maintenance Supervisor	Develop maintenance schedules Oversee and document maintenance Revise schedules as needed	New Equipment New Process Chemistry New Process Parameters New Procedures Change in Process Utilization	Inform operations manager of potential problem areas Inform training supervisor of any training revisions Inform contractors Revise schedules
Hazmat Team Chief	Develop and exercise ER plan Train responders Test and maintain ER equipment Coordinate with public responders Select participants in accident investigations	New Equipment New Process Chemistry New Process Parameters New Procedures Change in Process Utilization New regulatory requirements	Revise the ER plan as needed Inform operations manager of problems created by changes Work with training supervisor to revise training of team and others

EXHIBIT 5-1
SAMPLE MANAGEMENT DOCUMENTATION

Position	Primary Responsibility	Changes	Responsibility re: Changes
Health and Safety Officer	Oversee implementation of RMP Develop accident investigation procedures Oversee compliance audits Develop employee participation plans Conduct contractor evaluations Track regulations	New Equipment New Process Chemistry New Process Parameters New Procedures Change in Process Utilization New regulatory requirements	Inform all leads of new requirements and assign responsibilities Ensure that everyone is informed of changes and that changes are incorporated in programs as needed

CHAPTER 6: PREVENTION PROGRAM (PROGRAM 2)

6.1 ABOUT THE PROGRAM 2 PREVENTION PROGRAM

Most Program 2 processes are likely to be relatively simple and may be located at small businesses. EPA developed the Program 2 prevention program by identifying the basic elements that are the foundation of sound prevention practices — safety information, hazard review, operating procedures, training, maintenance, compliance audits, and accident investigation. By meeting other Federal regulations, state laws, industry codes and standards, and good engineering practices, you probably have already addressed most Program 2 prevention elements.

As important as each of the elements is, you will not gain the full benefit from them unless you integrate them into a risk management system that you implement on an on-going basis. For example, your hazard review must be built on the safety information you compile; the results of the hazard review should be used to revise and update your operating and maintenance procedures; workers must be trained in these procedures and must use them every day.

You will have substantially less documentation and record keeping responsibilities for a Program 2 process than you will for a Program 3 process. In addition, EPA has worked with various industry sectors to develop industry-specific model risk management programs for Program 2 and 3 processes (appended to this guidance). The industry-specific guidance helps by suggesting standard elements for the sector that EPA expects would be appropriate for particular businesses in the sector. If there is an industry-specific appendix for your sector, you should use that information to supplement this guidance.

There are seven elements in the Program 2 prevention program, which is set forth in the Part 68 regulations at Subpart C.. Exhibit 6-1 of this guidance sets out each of the seven elements and corresponding section numbers.

You must integrate these seven elements into a risk management program that you and your staff implement on a daily basis. Understanding and managing risks must be part of the way you operate. Doing so will provide benefits beyond accident prevention. Preventive maintenance and routine inspections will reduce the number of equipment failures and down time, and well-trained workers, aware of optimum operating parameters, will allow you to gain the most efficient use of your processes and raw materials.

6.2 SAFETY INFORMATION (§ 68.48)

The purpose of this requirement is to ensure that you understand the safety-related aspects of the equipment and processes you have, know what limits they place on your operations, and adopt accepted standards and codes where they apply. Having up-to-date safety information about your process is the foundation of an effective prevention program. Many elements (especially the hazard review) depend on the accuracy and thoroughness of the information this element requires you to provide.

EXHIBIT 6-1
SUMMARY OF PROGRAM 2 PREVENTION PROGRAM

Number	Section Title
§ 68.48	Safety Information
§ 68.50	Hazard Review
§ 68.52	Operating Procedures
§ 68.54	Training
§ 68.56	Maintenance
§ 68.58	Compliance Audits
§ 68.60	Incident Investigation

WHAT DO I NEED TO DO?

You must compile and maintain safety information related to the regulated substances and process equipment for each Program 2 process. You probably have much of this information already as a result of complying with OSHA standards or other rules. EPA has limited the information to what is likely to apply to the processes covered under Program 2. Exhibit 6-2 gives a brief summary of the safety information requirements for Program 2.

HOW DO I START?

MSDSs. If you are subject to this rule, you are also subject to the requirements to maintain Material Safety Data Sheets under the OSHA Hazard Communication Standard (HCS) (29 CFR 1910.1200). If you do not have an MSDS for a regulated substance, you should contact your supplier or the manufacturer for a copy. Because the rule states that you must have an MSDS that meets OSHA requirements, you may want to review the MSDS to ensure that it is, in fact, complete. Besides providing the chemical name, the MSDS for a regulated substance (or a mixture containing the regulated substance) must describe the substance's physical and chemical characteristics (e.g., flash point, vapor pressure), physical hazards (e.g., flammability, reactivity), health hazards, routes of entry, exposure limits (e.g., the OSHA permissible exposure level), precautions for safe handling, generally applicable control measures, and emergency and first aid procedures. (See 29 CFR 1910.1200(g) for the complete set of requirements for an MSDS.)

EXHIBIT 6-2
SAFETY INFORMATION REQUIREMENTS

You must compile and maintain this safety information:	You must ensure:	You must update the safety information if:
✔Material Safety Data Sheets ✔Maximum intended inventory ✔Safe upper and lower parameters ✔Equipment specifications ✔Codes & standards used to design, build, and operate the process	✔That the process is designed in compliance with recognized codes and standards	✔There is a *major change* at your business that makes the safety information inaccurate

Maximum Inventory. You must document the maximum intended inventory of any vessel in which you store or process a regulated substance above its threshold quantity. If you are not sure of the capacity of the vessel, you can obtain this information from the manufacturer of the vessel. In some cases, this information will be attached to the vessel itself.

You may want to check with any trade association or standards group that develops standards for your industry to determine if there are any limitations on inventories. For example, in some cases the maximum capacity of a tank may be 10,000 gallons, but an industry standard may recommend that the tank never be filled to more than 85 percent capacity. If you follow the standard, your maximum inventory would be 8,500 gallons.

Storage and Process Limits. You must document the safe upper and lower temperatures and pressures, process flows (if applicable), and compositions (if applicable) for your process.

Every substance has limits on the temperature and pressures at which it can be stored or used; these limits are determined by both the properties of the substance and the vessels it which it is kept. If you do not know these limits, you should contact your vendor, the substance manufacturer, or your trade association. They will be able to provide the data you need. It is important that you know these limits so you can take action to avoid situations where these limits may be exceeded. Many people are aware of the dangers of overheating their vessels, but extreme low temperatures also may pose hazards you should know about.

If you are moving substances through pipes or hoses, you need to define safe temperatures and pressures for that movement; again, these limits will be determined by both the substance and the piping. For example, the substance may tolerate high

pressures, but the pipes may have structural limits. To operate safely, you must have this information. The pipe manufacturer will be able to provide these data.

If you are reacting chemicals, you need to understand whether the reaction will be compromised if you vary the temperature or pressure. Again, it is important to define both the upper and lower limits. Reactions may become unstable outside of their limits and compromise safety. Check with the substance manufacturer for information on this subject if you are uncertain about the limits for particular substances you are using.

The requirement to compile and maintain information on process flows and compositions will apply to you if you transfer substances through piping or hoses and if you mix or react the substance. It is important in these cases that you understand the safe limits for flow and composition. The pipe or hose vendors will be able to provide you with the maximum flow rates that their products are designed to handle. You must also be aware of any hazards that could be created if your processes are contaminated; for example, if your substance or equipment could be contaminated by water, you must know whether that creates different hazards, such as corrosion.

For many Program 2 processes, reacting or mixing will not be an issue, but if you are mixing or reacting regulated substances, you should understand what will happen if the composition varies. If you are uncertain about the effects of changing composition and do not have a chemist or chemical engineer on your staff, the substance manufacturer should be able to help you.

Equipment Specifications. You must document the specifications of any equipment you use to store, move, or react regulated substances in a covered process. Equipment specifications will usually include information on the materials of construction, actual design, and tolerances. The vendor should be able to provide this information; you may have the specifications in your files from the time of purchase. Many vessels and other pieces of equipment provide specification data on an attached nameplate. You are not expected to develop engineering drawings of your equipment to meet this requirement, but you must be able to document that your equipment is appropriate for the substances and activities for which it is used, and you must know what the limits of the equipment are.

Specifications are particularly important if your vessels or pipes are not specifically designed for your type of operation. Substances may react with certain metals or corrode them if water is introduced. You should be sure that the vessels you purchase or lease are appropriate for your operations. Understanding equipment specifications will help you when you need to buy replacement parts. Any such parts must be appropriate for your existing equipment and your use of that equipment. It is not sufficient to replace parts with something that "fits" unless the new part meets the specifications; substitution of inappropriate parts may create serious hazards.

Codes and Standards. You must document the codes and standards you used to design and build your facility and that you follow to operate. These codes will probably include the electrical and building codes that you must comply with under state or local laws. Your equipment vendors will be able to provide you with

information on the codes they comply with for their products. Exhibit 6-3 below lists some codes that may be relevant to your operation. Note that the National Fire Protection Association (NFPA) codes may have been adopted as state or local codes. The American National Standards Institute (ANSI) is an umbrella standards-setting organization, which imposes a specific process for gaining approval of standards and codes. ANSI codes may include codes and standards also issued by other organizations.

EXHIBIT 6-3
CODES AND STANDARDS

ORGANIZATION	SUBJECT/CODES
American National Standards Institute (ANSI)	Piping, Electrical, Power wiring, Instrumentation, Lighting, Product storage and handling, Insulation and fireproofing, Painting and coating, Ventilation, Noise and Vibration, Fire protection equipment, Safety equipment, Pumps, Compressors, Motors, Refrigeration equipment, Pneumatic conveying
American Society of Mechanical Engineers (ASME)	Power boilers, Pressure vessels, Piping, Compressors, Shell and tube heat exchangers, Vessel components, General design and fabrication codes
American Petroleum Institute (API)	Welded tanks, Rotating equipment, Bulk liquid storage systems
National Fire Protection Association (NFPA)	Fire pumps, Flammable liquid code, LNG storage and handling, Plant equipment and layout, Electrical system design, Shutdown systems, Pressure relief equipment, Venting requirements, Gas turbines and engines, Cooling towers, Storage tanks
American Society for Testing Materials (ASTM)	Inspection and testing, Noise and vibration, Materials of construction, Piping materials and systems, Instrumentation

HOW DO I DOCUMENT ALL THIS?

EPA does not expect you to develop piles of papers to document your safety information. Your MSDS(s) are usually three or four pages long. You only have to keep them on file, as you already do for OSHA. Equipment specifications are usually on a few sheets or in a booklet provided by the vendor; you need only keep these on file. You can probably document the other information on a single sheet that simply lists each of the required items and any codes or standards that apply. See Exhibit 6-4 below for a sample. Maintain that sheet in a file and update it whenever any item changes or new equipment is added.

EXHIBIT 6-4
SAMPLE SAFETY INFORMATION SHEET

PROPANE STORAGE	
MSDS Propane	On file (1994)
Maximum Intended Inventory	400,000 pounds
Temperature	Upper: max 110°F Lower: min -15°F
Pressure	Upper: 240 psi @ 110°F Lower: 35 psi @ -15°F
Flow Rate	Loading: 100 GPM (max) Unloading: 265 GPM (max)
Vapor Piping	250 PSIG
Liquid Piping and Compressor Discharge	350 PSIG
Safety Relief Valves	Each relieves 9,250 SCFM/air RV 1 replaced 9/96 RV 2 replaced 6/97 RV 3 replaced 8/98
Excess Flow Valve	3", closes at 225 GPM with 100 PSIG inlet 2", closes at 100 GPM with 100 PSIG inlet 2", closes at 34,500 SCFH with 100 PSIG inlet
Emergency Shutoff Valve	ESV 1 1/4", closes at 26,000 SCFH with 100 PSIG inlet ESV 2", closes at 225 GPM with 100 PSIG inlet
Codes and Standards	Designed under NFPA-58-1985
Piping Design	ASME B31-3
Tank Design	ASME NB# 0012

The equipment specifications and list of any applicable standards and codes will probably meet the requirement that you ensure that your process is designed in compliance with recognized and generally good engineering practices. If you have any doubt that you are meeting this requirement, your trade association or implementing agency may be helpful in determining if there are practices or standards that you are not aware of that may be useful in your operation.

After you have documented your safety information, you should double check it to be sure that the files you have reflect the equipment you are currently using. It is important to keep this information up to date. Whenever you replace equipment, be

sure that you put the new equipment specifications in the file and consider whether any of your other prevention elements need to be reviewed to reflect the new equipment.

UPDATING SAFETY INFORMATION

The Part 68 rule also requires that you update your safety information whenever a major change occurs that makes the information inaccurate. Such changes can include changes in process design or operation that can significantly affect other portions of your risk management program. Before starting up a process after a major change, all relevant elements of the risk management program, including prevention program elements, must be reviewed and updated as appropriate. For example, a major change in process operation may require you to update your safety information, as well as your hazard review and operating procedures. Operators must be trained in any updated procedures before starting up the changed process. Additionally, a major process change could potentially require you to update your offsite consequence analysis if, for example, you substantially increase your regulated substance inventory or install a passive mitigation system.

In updating safety information subsequent to a major process change, you should also determine whether new or revised information relevant to your process has become available. For example, since federal, state and industry standards are part of the safety information that must be compiled, any new or revised standards that are applicable to the change itself or to the changed process should be reflected in the update.

WHERE TO GO FOR MORE INFORMATION

MSDSs. MSDSs are available from a number of websites. Chemical manufacturers' websites are often the best source of up-to-date MSDS information. Other on-line MSDS databases have multiple copies of MSDSs for each substance and can help you find an MSDS that is well organized and easy to read. EPA has not verified the accuracy or completeness of MSDSs on any website nor does it endorse any particular version of an MSDS. You should review any MSDS you use to ensure that it meets the requirements of OSHA's hazard communication standard (29 CFR 1910.1200).

Guidance and Reports. Although the publications below target the chemical industry, you may find useful information in them:

- Guidelines for Process Safety Documentation, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1995.
- Loss Prevention in the Process Industries, Volumes I, II, and III, Frank P. Lees, Butterworths: London 1996.

6.3 HAZARD REVIEW (§ 68.50)

For a Program 2 process, you must conduct a hazard review. EPA has streamlined the process hazard analysis (PHA) requirement of OSHA's PSM standard to create a

requirement that will detect process hazards at the simpler processes in Program 2. The hazard review will help you determine whether you are meeting applicable codes and standards; identify, evaluate and address the types of potential failures; and focus your emergency response planning efforts. Many Program 2 processes are covered by industry-specific risk management program guidance (appended to this guidance) that will help with this hazard review.

WHAT DO I NEED TO DO?

The hazard review is key to understanding how to operate safely on a continuous basis. You must identify and review specific hazards and safeguards for your Program 2 processes. EPA lists the types of hazards and safeguards in the rule. Exhibit 6-5 below summarizes things you must do for a hazard review.

EXHIBIT 6-5
HAZARD REVIEW REQUIREMENTS

Conduct a review & identify...	Use a guide for conducting the review.	Document results & resolve problems.	Update your hazard review.
✔The hazards associated with the Program 2 process & regulated substances. ✔Opportunities for equipment malfunction or human error that could cause a release. ✔Safeguards that will control the hazards or prevent the malfunction or error. ✔Steps to detect or monitor releases.	✔You may use any checklist (e.g., one provided in industry-specific risk management program guidance) to conduct the review. ✔For a process designed to industry standards like NFPA-58 or Federal /state design rules, check the equipment to make sure that it's fabricated, installed, and operated properly.	✔Your hazard review must be documented and you must show that you have addressed problems.	✔You must update your review at least once every five years or whenever there is a major change in the process. ✔In the case of a major change, you must resolve problems identified in the new review *before* you startup the changed process.

HOW DO I START?

There are three possible approaches to conducting a hazard review; which you use depends on your particular situation.

1. Processes designed to legal or industry-specific codes. If your process was designed and built to comply with a federal or state standard for your industry or an

industry-specific design code, your hazard review may largely rely on the standard or code to identify hazards. The standard-setting organization has conducted a hazard review for that type of process, identified the hazards, and developed equipment and operating requirements to minimize the risks. You can use the code or standard as a checklist. You need supplement that checklist only to the extent you are aware of other hazards that the standard or code does not address. The purpose of your review is to ensure that your equipment meets the code, addresses any other hazards to the extent practicable and is being operated in appropriate ways.

If you have a single vessel or other simple equipment, you can probably conduct the review relatively quickly. You will need a copy of the code or standards and someone who is familiar with both the requirements and your equipment to ensure that the person can reasonably assess your compliance. If you have an operating engineer, he or she may be able to conduct the review. If you do not have any technical staff, your vendor or trade association may be able to help you. If you seek outside help, however, work with whoever conducts the review so that you understand what they find. Also, to the extent the person conducting the review identifies hazards not addressed by the code or standard, you should address those hazards to the extent practicable.

2. Industry checklist/industry-specific risk management program. If there is not a single code or standard you must meet, you may want to use a checklist developed by a third party, such as a national trade association. EPA has also developed supplemental guidance for industry-specific risk management programs for some industry sectors. These guidance documents are appended to this guidance, and include checklists that may provide an adequate basis for your review.

If you use guidance provided by a trade association or EPA, it probably identifies what your hazards are and what types of equipment and procedures you should be using. Your job is to use the checklist to decide if you meet the requirements and, if you do not, whether you should. In some cases, your individual circumstances may make a checklist item unnecessary or may pose hazards not identified by the checklist that you should consider.

As with an industry-specific standard, if you have an operating engineer or an operator knowledgeable about the equipment and process, he or she may be able to conduct the review. If you do not have any technical staff, your vendor or trade association may be able to help you. If you seek outside help, however, work with whoever conducts the review so that you understand what they find.

If you use an industry standard or model, you may have to modify it to address site-specific concerns. Never use someone else's checklist blindly. You must be sure that it addresses all of your potential problems.

3. Develop your own checklist. If you have no industry-specific standards or checklists, you will have to design your own hazard review. As discussed in the requirements section (Exhibit 6-5), the review must identify:

- The hazards of the regulated substance and process;

- Possible equipment failures or human errors that could lead to a release;
- Safeguards used or needed to prevent failures or errors; and
- Steps used or needed to detect or monitor releases.

You will probably be able to define the hazards of the substance using the MSDS, which lists the hazardous properties of the substance. The hazards of the process (as opposed to the equipment) will be limited for many Program 2 processes. However, if you react or mix chemicals, if your process could be contaminated by water or other chemicals, or if you operate a process involving high temperatures or pressures or have other unique circumstances, you may have process hazards that you need to identify. Your safety information should help here.

The next step may be to conduct a simplified "What If" process, where your technical staff ask "What if it stops or fails?" for each piece of equipment and "What if the operator fails to do this?" for each procedure. Most industry standards and codes consider these questions and provide responses in terms of design standards and operating practices. If you are doing this on your own, the important thing to remember is that you should not assume that an equipment failure or human error will not happen. Ask whether the safeguards that you think protect the equipment or operator are really adequate. In many cases, they may be adequate, but it is useful to ask, to force yourself to examine your own assumptions.

From this exercise, you should develop a checklist of items that you need to consider. For example, if you have listed mixing tank pump failure as a possible problem, the checklist might then include the following items to check: pump maintenance plans, tank high-level alarms, overflow tanks. You would also want to ask what effect a power outage would have on the pump. You may want to consider the particular procedures that have to be followed for safe operation of the equipment and ask what would happen if an operator omits a step or does them out of order. Do your procedures address these possible problems? Would failure of the pump affect the safe operating limits you have documented in your safety information?

When you finish the checklist, it is useful to show it to your operators. They are familiar with the equipment and may be able to point out other areas of concern. A review with your vendors or trade association may also help; their wider knowledge of the industry may give them ideas about failures you may not have experienced or considered.

You may also use any of the other techniques described in Appendix 7-A to Chapter 7. These techniques generally require more trained staff and more time; they are particularly appropriate for processes that involve reacting or manufacturing chemicals.

NATURAL EVENTS AND OTHER OUTSIDE INFLUENCES

Whichever approach you use, you should consider reasonably anticipated external events as well as internal failures. If you are in an area subject to earthquakes,

hurricanes, or floods, you should examine whether your process would survive these natural events without releasing the substance. In your hazard review, you should consider the potential impacts of lightning strikes and power failures. If your process could be hit by vehicles, you should examine the consequences of that. If you have anything near the process that could burn, ask yourself what would happen if the fire affected the process. For example, if you have a propane tank and an ammonia tank at your facility and they are close to each other, when you look at the ammonia tank you should consider what a fire in the propane tank would do to the ammonia. These considerations may not be part of standard checklists or model programs.

In addition, you may want to check with vendors, trade associations, or professional organizations to determine if there are new standards for safety systems or designs, or if there are detection or mitigation systems that may be applicable to your process that you should consider when you evaluate your existing equipment. If your equipment is designed and built to an earlier version of a standard, you should consider whether upgrades are needed.

RESPONDING TO FINDINGS

The person or persons who conduct the review should develop a list of findings and recommendations. You must ensure that problems identified are addressed in a timely manner. EPA does not require that you implement every recommendation. It is up to you to make reasonable decisions about which recommendations are necessary and feasible. You may decide that other steps are as effective as the recommended actions or that the risk is too low to merit the expense. You must, however, document your decision on each recommendation. If you are implementing a recommendation, you should document the schedule for implementation. If you are taking other steps to address the problem or decide the problem does not merit action, you should document the basis for your decision.

DOCUMENTING THE REVIEW

You should maintain a copy of the checklist or other documentation appropriate to the review method you used. For a checklist approach, the easiest way to document findings is to enter them on the checklist after each item. This approach will give you a simple, concise way of keeping track of findings, recommendations and conducting follow-up to resolve recommendations. You may also want to create a separate document of recommendations that require implementation or other resolution. Exhibit 6-6 is a partial checklist developed for a propane storage facility risk management program; it provides a sample of the level of detail needed in a checklist and a format for documenting your findings (if you are conducting a hazard review for a propane storage facility, do not use this checklist - use the complete checklist provided in the Supplemental Risk Management Program Guidance for Propane Storage Facilities (appended to this guidance).

EXHIBIT 6-6
SAMPLE CHECKLIST (EXTRACT)*

Piping, Equipment, Container Appurtenances	Yes/No/NA	Comments/Follow-up
1. On installations with stairways and ladders, are catwalks provided so personnel need not walk on any portion of the vessel?		
2. Is piping designed in accordance with ASME B31.3, 1993 edition? Pump and compressor discharge and liquid transfer lines shall be suitable for a working pressure of 350 psi (3-2.8.2(a) of NFPA 58, 1995 edition) Vapor piping shall be suitable for a working pressure of 250 psi (3-2.8.2(b of NFPA 58, 1995 edition)		
3. Is the capacity of the pressure relief devices designed as specified in 2-3.2 and 3-2.5 of NFPA 58, 1995 edition?		
4. Are appropriate level gauges, temperature indicators, and pressure gauges installed on fixed ASME storage tanks as specified in 2-3.3.2(b), 2-3.3.3, 2.3.4, 2.3.5 of NFPA 58, 1995 edition?		
5. Are appropriate hydrostatic relief valves installed between every section of liquid piping, which can be blocked by manual or automatic valves as specified in 2-4.7 and 3-2.9 of NFPA 58, 1995 edition?		
6. Is appropriate corrosion protection installed as required by 3-2.12 of NFPA 58, 1995 edition?		
7. On installations with pumps, are they installed as specified in 3-2.13 of NFPA 58, 1995 edition? On installations with an automatic bypass valve, are they installed on the discharge of the pump as specified in 3-2.13(b)(1) and 2-5.2 of NFPA 58, 1995 edition?		

* Note: Standard and code citations included in this sample are provided as examples. Industry codes and standards are revised on a periodic basis, and their requirements may change significantly from one edition to the next. In designing or implementing a checklist, you should consult the edition of the industry standard that applies to the relevant process (or process change), and incorporate the applicable requirements into your hazard review.

UPDATES

You must update the review every fifth year or whenever a major change in a process takes place, whichever occurs first. For most Program 2 processes, major changes are likely to occur infrequently. If you install a new tank next to an existing one, you would want to consider whether the closeness of the two creates any new hazards. Replacing a tank with an identical tank would not be considered a change. Replacing a tank with a new type of tank should trigger an update. Changing process composition or safe operating limits is considered a major change. Even if changes prove to be minor, you should examine the process carefully before starting. Combining old and new equipment can sometimes create unexpected hazards. You will operate more safely if you take the time to evaluate the hazards before proceeding.

WHERE TO GO FOR MORE INFORMATION

Although the publications below target the chemical industry, you may find useful information in them:

- *Guidelines for Hazard Evaluation Procedures, 2nd Ed. with Worked examples*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1992.
- *Evaluating Process Safety in the Chemical Industry*, Chemical Manufacturers Association.
- *Loss Prevention in the Process Industries*, Volumes I, II, and III Frank P. Lees, Butterworths: London 1996.
- *Management of Process Hazards* (R.P. 750), American Petroleum Institute.
- *Risk-Based Decision Making (Publication 16288)*, American Petroleum Institute.

6.4 OPERATING PROCEDURES (§ 68.52)

Written operating procedures describe in detail what tasks a process operator must perform, set safe process operating parameters that must be maintained, and set safety precautions for operations and maintenance activities. These procedures are the guide for telling your employees how to work safely everyday, giving everyone a quick source of information that can prevent or mitigate the effects of an accident, and providing workers and management with a standard against which to assess performance.

WHAT DO I NEED TO DO?

You must prepare written operating procedures that give workers clear instruction for safely conducting activities involving a covered process. You may use standardized procedures developed by industry groups or provided in industry-specific risk management program guidance documents as the basis for your

operating procedures, but be sure to check that these standard procedures are appropriate for your activities and modify them as needed. You must ensure that your operating procedures are updated, if necessary, whenever there is a major change and before you startup the changed process. Exhibit 6-7 briefly summarizes what your operating procedures must address.

EXHIBIT 6-7
OPERATING PROCEDURES REQUIREMENTS

Steps for each operating phase	Other Procedures
✔Initial startup	✔Consequences of deviating
✔Normal operations	✔Steps to avoid, correct deviations
✔Temporary operations	✔Equipment inspections
✔Emergency shutdown	
✔Emergency operations	
✔Normal shutdown	
✔Startup following a normal or emergency shutdown or a major change	

Your operating procedures must be:

- Appropriate for your equipment and operations;
- Complete; and
- Written in language that is easily understood by your operators [e.g., if your operators include persons whose primary language is Spanish, you should consider whether the instructions should be provided in Spanish as well as English].

The procedures do not have to be long. If you have simple equipment that requires a few basic steps, that is all you have to cover.

HOW DO I START?

If you already have written procedures, you may not have to do anything more. Review the procedures. You may want to watch operators performing the steps to be sure that the procedures are being used and are appropriate. Talk with the operators to identify any problems they have identified and any improvements they may have made or would suggest. When you are satisfied that they meet the criteria listed above, you are finished. You may want to check them against any recommended procedures provided by equipment manufacturers, trade associations, or standard setting organizations, but you are not required to do so. You are responsible for ensuring that the procedures explain how to operate your equipment and processes safely.

If you do not have written procedures, you may be able to review your standard procedures with your operators and write them down. You also may want to check

with equipment manufacturers, trade associations, or standard setting organizations. They may have recommended practices and procedures that you can adapt. Do not accept anyone else's procedures without checking to be sure that they are adequate and appropriate for your particular equipment and uses and are written in language that your operators will understand. You may also want to review any requirements imposed under state or federal rules. For example, if you are subject to federal rules for loading and unloading of hazardous materials, those rules may dictate some procedures. Copies of these rules may be sufficient for those operations if your operators can understand and use them.

WHAT DO THESE PROCEDURES MEAN?

The rule lists eight types of procedures. Not all of them may be applicable to you. The following is a brief description to help you decide whether you need to develop procedures for each item. If a particular element does not apply, do not spend any time on it. We do not expect you to create a document that is meaningless to you. You should spend your time on items that will be useful to you.

Initial Startup. This item applies primarily to facilities that process or use substances and covers all the steps you need to take before you start a process for the first time. You should include all the steps needed to check out equipment as well as the steps needed to start the process itself. If you simply store a regulated substance, there is no startup. Warehouses, for example, will probably not have procedures for startup. Retailers who store a substance and download it should have procedures for checking out and loading the vessel for the first time for this item.

Normal Operations. These procedures should cover your basic operations. If you are a warehouse, these would include stacking, moving, and repackaging, if you do that. For retailers, they would cover loading and downloading. For users, the procedures would include all the steps operators take to check the process and ensure that equipment is functioning properly and substances are flowing or mixing appropriately. These are your core procedures that you expect your operators to follow on a daily basis to run your processes safely.

Temporary Operations. These operations are short-term; they will usually occur either when your regular process is shut down or when additional capacity is needed for a limited period. The procedures should cover the steps you need to take to ensure that these operations will function safely. The procedures will generally cover pre-startup checks and determinations (e.g., have you determined what the maximum flow rate will be). The actual operating procedures for running the temporary process must be written, and operators must be trained to use them, before the operation is put into place.

This item may apply to most facilities. Even warehouses may need to consider procedures to ensure that if a new substance or product is brought into the warehouse for temporary storage, the necessary steps are taken before that storage occurs to ensure that it is safe (e.g., barrels are not stacked too high or located with incompatible substances). If it is possible that you will operate your process in a way that is not covered under normal operations, you should have procedures for

temporary operations. If you will simply shutdown your process (e.g., stop unloading the substance), you can ignore this item.

Emergency Shutdowns and Operations. These procedures cover the steps you need to take if you must shutdown your process quickly. For most Program 2 facilities, these procedures will be brief because shutting a process down will be little different in an emergency than in ordinary circumstances; you will simply shut off the flow or stop any unloading or loading. For warehouses, they may not apply. If you have a more complex process (e.g., one that operates under high pressure or temperature), you will need procedures to ensure that you can shutdown safely. Normally you gradually reduce flows, depressurize, and lower temperatures. If you need to do any of these quickly, you must have procedures that identify the steps workers should take to carry out these operations safely.

Normal Shutdown. These procedures apply mainly to facilities that process or use regulated substances. They may apply to you even if you only store a substance and you empty the tank for cleaning. These procedures probably will not apply to warehouses unless they repackage.

These procedures should provide all the steps needed to stop a process safely. For a complex process or one that operates under extreme conditions, shutdown may take considerable time and may be hazardous. The procedures should set out the time that should be taken and the checks that must be made before proceeding to the next steps.

Startup following a normal or emergency shutdown or a major change. These procedures may be similar to those for initial startup. Startup procedures following normal shutdown may include fewer equipment checks because you may not need to check equipment on a frequent basis. You should include all the steps your workers should take to ensure that the process can operate safely. Startup after an emergency shutdown will generally require more checks to ensure that valves that were closed are open and that they and other equipment are still functioning properly. These procedures will be limited if you only store a substance; they may not apply to warehouses in most instances.

Consequences of Deviations. Your operating procedures should tell the workers what will happen if something starts to go wrong. For example, if the pressure or temperature begins to rise or fall unexpectedly or the flow rate from one feed suddenly drops sharply, the operator must know (1) whether this poses a problem that must be addressed, and (2) what steps to take to correct the problem or otherwise respond to it. Your safety information will have defined the safe operating limits for your substances and processes; the hazard review will have defined the possible consequences and the steps needed to prevent a deviation from causing serious problems. You should include this information in each of the other procedures (startup, normal operations, shutdowns), rather than as separate documents.

If your substance is one that has a distinctive odor, color, or other characteristic that operators will be able to sense, you should include in your procedures information about what to do if they notice leaks. Frequently, people are the most sensitive leak

detectors. Take advantage of their abilities to catch leaks before they become serious.

Equipment Inspections. You should include steps for routine inspection and surveillance of equipment by operators as part of your other procedures. These inspections cover the items that operators should look for on a daily basis to be sure that the equipment is running safely (e.g., vibration checks). These inspections are not the same as those detailed checks that maintenance workers will perform, but rather are the "eyeball," "sound," and "feel" tests that experienced operators do, often without realizing it. Your operators, your vendors, and your trade association can help you define the things that should trigger concern: When is a small leak at a seal normal; when is it a cause of concern? How much vibration is normal? What does a smoothly running motor sound like?

UPDATING PROCEDURES

You must update your procedures whenever you change your process in a way that alters the steps needed to operate safely. If you add new equipment, you will need to expand your procedures or develop a separate set to cover the new items. Whenever you change your safety information you should review your procedures to be sure that they are still appropriate. Anytime you conduct a hazard review, check your operating procedures as you implement changes to address hazards.

WHAT KIND OF DOCUMENTS DO I HAVE TO KEEP?

You must maintain your current set of operating procedures. You are not required to keep old versions; in fact, you should avoid doing so because keeping copies of outdated procedures may cause confusion. You should date all procedures so you will know when they were last updated.

WHERE TO GO FOR MORE INFORMATION

Although the reports below target the chemical industry, you may find useful information in them:

- *Guidelines for Process Safety Fundamentals for General Plant Operations*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1995.
- *Guidelines for Safe Process Operations and Maintenance*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1995
- *Guidelines for Writing Effective Operating and Maintenance Procedures*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1996.

6.5 TRAINING (§ 68.54)

Training programs often provide immediate benefits because trained workers have fewer accidents, damage less equipment, and improve operational efficiency. Training gives workers the information they need to understand how to operate safely and why safe operations are necessary. A training program, including refresher training, is the key to ensuring that the rest of your prevention program is effective. You already have some type of training program because you must conduct training to comply with OSHA's Hazard Communication Standard (29 CFR 1910.1200).

WHAT DO I NEED TO DO?

You must train all new workers in your operating procedures developed under the previous prevention program element; if any of your more experienced workers need training on these procedures, you should also train them. For workers already operating a process on June 21, 1999, you may certify in writing that the employees have the "required knowledge, skills, and abilities to safely carry out the duties and responsibilities as provided in the operating procedures" (§ 68.54(a)). This "grandfather clause" means that you do not need to conduct additional training for workers operating a process by June 21, 1999, who have the appropriate knowledge and skills to operate the process safely, in accordance with the operating procedures. This certification should be kept in your files; you should not submit it to EPA unless specifically requested by an EPA official.

Any time operating procedures are revised, you must train everyone using the new procedures. At least once every three years, you must provide refresher training on the operating procedures even if they have not changed. The training must cover all parts of the operating procedures, including information on the consequences of deviations and steps needed to address deviations.

You are not required to provide a specific amount of training or type of training. You should develop a training approach that works for you. If you are a small facility, one-on-one training and on-the-job training may work best. Larger facilities may want to provide classroom training or video courses developed by vendors or trade associations before moving staff on to supervised work. You may have senior operators present the training or use trainers provided by vendors or other outside sources. The form and the length of the training will depend on your resources and your processes. If you can teach someone the basics in two hours and safely move them on to supervised work, that is all right. The important thing is that your workers understand how to operate safely and can carry out their tasks properly. Find a system that works for you. Exhibit 6-8 lists things that you may find useful in developing your training program.

You are also required to ensure that each worker trained has understood the training and is competent to operate the process safely. You may decide what kind or kinds of competency testing to use. Observation by a senior operator may be appropriate in many cases. If you provided classroom training, you may want to use both testing and demonstration or observation. You are required to report in the RMP on the type(s) of competency testing you use.

EXHIBIT 6-8
TRAINING CHART

✔**Who needs training?**	Clearly identify the employees who need to be trained and the subjects to be covered.
✔**What are the objectives?**	Specify learning objectives, and write them in clear, measurable terms before training begins. Remember that training must address the process operating procedures.
✔**How will you meet the training objectives?**	Tailor the specific training modules or segments to the training objectives. Enhance learning by including hands-on training like using simulators whenever appropriate. Make the training environment as much like the working environment as you can, consistent with safety. Allow your employees to practice their skills and demonstrate what they know.
✔**Is your training program working?**	Evaluate your training program periodically to see if your employees have the skills and know the routines required under your operating procedures. Make sure that language or presentation are not barriers to learning. Decide how you will measure your employees' competence.
✔**How will your program work for new hires and refresher training?**	Make sure all workers – including maintenance and contract employees – receive initial and refresher training. If you make changes to process chemicals, equipment, or technology, make sure that involved workers understand the changes and the effects on their jobs.

HOW DOES THIS TRAINING FIT WITH OTHER REQUIRED TRAINING?

You are required by OSHA to provide training under the Hazard Communication Standard (29 CFR 1910.1200); this training covers the hazards of the chemicals and steps to take to prevent exposures. DOT has required training for loading and unloading of hazardous materials (49 CFR part 172, subpart H). Some of that training will likely cover items in your operating procedures. You do not need to repeat that training to meet EPA's requirements. You may want to integrate the training programs, but you do not have to do so.

WHAT KIND OF DOCUMENTATION DO I NEED TO KEEP?

In the RMP, you are required to report on the date of the most recent review or revision of your training program. You are also required to report on the type of training required (e.g., classroom or on-the-job) and the type of competency testing used. You should keep on site any current training materials or schedules used. The rule does not require you to keep particular records of your training program. It is enough for you to have on site information that supports what is reported in the RMP and your implementation of the training program overall. You may want to keep an attendance log for any formal training courses and refresher training to ensure that everyone who needs to be trained is trained. Such logs will help you perform a compliance audit or demonstrate compliance with the rule although you are not required to keep logs for this rule.

WHERE TO GO FOR MORE INFORMATION

- *Guidelines for Process Safety Fundamentals for General Plant Operations*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1995.
- *Guidelines for Technical Planning for On-Site Emergencies*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1995.
- *Federally Mandated Training and Information* (Publication 12000), American Petroleum Institute.

6.6 MAINTENANCE (§ 68.56)

Preventive maintenance, inspection, and testing of equipment is critical to safe operations. Waiting for equipment to fail often means waiting for an accident that could harm people and the environment. Further, a thorough maintenance program will save you money by cutting down-time caused by equipment failures. Your hazard review and safety information will have identified equipment that is critical to safe operations. You should use that information to build your maintenance program.

WHAT DO I NEED TO DO?

You must prepare and implement procedures for maintaining the mechanical integrity of process equipment, and train your workers in the maintenance procedures. You may use procedures or instructions from equipment vendors, in Federal or state regulations, or in industry codes as the basis of your maintenance program. You should develop a schedule for inspecting and testing your equipment based on manufacturers' recommendations or your own experience if that suggests more frequent inspection or testing is warranted. Exhibit 6-9 briefly summarizes the elements of a maintenance program that would satisfy EPA's rule.

HOW DO I START?

Your first step will probably be to determine whether you already meet all these requirements. If you review your existing written procedures and determine that they are appropriate, you do not need to revise or rewrite them. If your workers are already trained in the procedures and carry them out, you may not need to do anything else.

If you do not have written procedures, you will need to develop them. Your equipment vendors may be able to provide procedures and maintenance schedules. Using these as the basis of your program is acceptable unless your use varies from that contemplated by the vendor or manufacturer (see below). Your trade association may also be able to help you with industry-specific checklists. If there are existing industry standards, your trade association can provide you with the references. Copies of these may form the basis for your maintenance program. If

there are federal or state regulations that require certain maintenance, you should use these as well.

EXHIBIT 6-9
MAINTENANCE GUIDELINES

Written procedures	Training	Inspection & testing
✔You may use procedures provided by the vendor or trade association, etc., as the basis for your program. If you choose to develop your own, you must write them down.	✔Train process maintenance employees in process hazards and how to avoid or correct an unsafe condition. ✔Make sure this training covers the procedures applicable to safe job performance.	✔Inspect & test process equipment. ✔Use recognized and generally accepted good engineering practices. ✔Follow a schedule that matches the manufacturer's recommendations or that prior operating experience indicates is necessary.

You need to determine if procedures provided by vendors, manufacturers, trade associations, or others are appropriate for your operation. If your safety information indicates that you are operating in a standard way (e.g., using only parts designed for refrigeration service in your cold storage system), you may assume that these other procedures will work for you. If you are using equipment for purposes other than those for which it was designed, you need to decide whether your use changes the kinds of maintenance required.

TRAINING

Once you have written procedures, you must ensure that your maintenance workers are trained in the procedures and in the hazards of the process. As with the training discussed in the previous section, how you provide this training is up to you. We believe that you are in the best position to decide how to train your workers. Vendors may provide the training or videos; you may already provide training on hazards and how to avoid or correct them as part of Hazard Communication Standard training under OSHA regulations. You do not need to repeat this training to comply with this rule.

If you hire contractors to do your maintenance, you should ensure that they are trained to carry out the procedures. Under the rule, any maintenance contractor is required to ensure that each contract maintenance worker is trained to perform the maintenance procedures developed by the facility. You can help this process by providing training or by developing agreements with the contractor that give you the assurance that only trained workers will be sent to your site. For any outside worker, you must ensure that they are informed of the hazards of your particular process. If you have standard equipment and hire contractors that specialize in servicing your types of processes, you can ensure their knowledge through agreements with the contractor.

INSPECTION AND TESTING

You must establish a schedule for inspecting and testing equipment associated with covered processes. The frequency of inspections and tests must be consistent with manufacturer's recommendations, industry standards or codes, good engineering practices, and your prior operating experience. In particular, you should use your own experience as a basis for examining any schedules recommended by others. Many things may affect whether a schedule is appropriate. The manufacturer may assume a constant rate of use (e.g., the amount of substance pumped per hour). If your use varies considerably, the variations may affect the wear on the equipment. Extreme weather conditions may also impact wear on equipment.

Talk with your operators as you prepare or adopt these procedures and schedules. If their experience indicates that equipment fails more frequently than the manufacturer expects, you should adjust the inspection schedule to reflect that experience. Your hazard review will have identified these potential problem areas as well and should be used as you develop schedules. For example, if you determine that corrosion is one of the hazards of the process, your schedule must address inspections for corrosion and replacement before failure. Your trade association may also be able to provide advice on these issues.

WHAT KIND OF DOCUMENTATION MUST I KEEP?

In the RMP, you are required to report on the date of the most recent review or revision of your maintenance procedures and the date of the most recent equipment inspection or test and equipment inspected or tested. You must keep on site your written procedures and schedules as well as any agreements you have with contractors. The rule does not require that you keep particular records of your maintenance program. It is enough for you to have on site information that supports what is reported in the RMP and your implementation of the maintenance program overall. For example, you may want to keep maintenance logs to keep track of when inspections and tests were done.

WHERE TO GO FOR MORE INFORMATION

Codes and Standards: The following groups develop codes and standards that may help you determine the appropriate frequency and methods to use for testing and inspection: National Board Inspection Code, the American Society for Testing and Material, American Petroleum Institute, National Fire Protection Association, American National Standards Institute, American Society of Mechanical Engineers.

Guidance and Reports. Although the reports below target the chemical industry, you may find useful information in them:

- *Guidelines for Equipment Reliability Data with Data Tables*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1989.

- *Guidelines for Process Safety Documentation*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1995.

- *Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration* (API 510), American Petroleum Institute.
- *Tank Inspection, Repair, Alteration, and Reconstruction (Std 653)*, American Petroleum Institute.

Q & A
MAINTENANCE

Q. I use propane as a raw material in my manufacturing process. I lease the tank from the propane supplier. The supplier does all the maintenance. My staff never work on the equipment. What should I do?

A. As part of your contract with the supplier, it would be helpful to gain an agreement, in writing, that the supplier will provide maintenance and trained maintenance workers that meet the requirements of 40 CFR 68.56.

6.7 COMPLIANCE AUDITS (§ 68.58)

Any risk management program should be reviewed periodically to ensure that employees and contractors are implementing it properly. A compliance audit is a way for you to evaluate and measure the effectiveness of your risk management program. An audit reviews each of the prevention program elements to ensure that they are up-to-date and are being implemented and will help you identify problem areas and take corrective actions. As a result, you'll be running a safer operation.

WHAT DO I NEED TO DO?

At least every three years, you must certify that you have evaluated compliance with the prevention program requirements for each covered process. At least one person on your audit team must be knowledgeable about the covered process. You must develop a report of your findings, determine and document an appropriate response to each finding, and document that you have corrected any deficiency.

You must review compliance with each of the required elements of the prevention program. Because Program 2 processes are generally simple, the audit should not take a long time. You may want to develop a simple checklist; Exhibit 6-10 provides a sample format.

Once you have the checklist, you, your chief operator, or some other person who is knowledgeable about your process, singly or as a team, should walk through the facility and check on relevant items, writing down comments and recommendations. For example, you may want to talk with employees to determine if they have been trained and are familiar with the procedures.

You must respond to each of the findings and document what actions, if any, you take to address problems. You should take steps to correct any deficiencies you find.

You may choose to have the audit conducted by a qualified outside party. For example, you may have someone from another part of your company do the audit or hire an expert in your process. If you do either of these, you should have an employee who works with or is responsible for the process work with the auditor, both to understand the findings and answer questions.

Again, the purpose of the compliance audit is to ensure that you are continuing to implement a prevention program as required. Remember, the risk management program is an on-going process; it is not a set of documents that you develop and put on a shelf in case the government inspects your site. Indeed, government inspectors will expect your facility operators to be familiar with and implementing your accident prevention program. To be in compliance with (and gain the benefits of) the rule, procedures must be followed on a daily basis; documents must be kept up to date. Your compliance audit must check compliance with each prevention program element and indicate areas that need to be improved. You may choose to expand the scope to cover your compliance with other parts of the rule and the overall safety of your operation, but you are not required to do so.

WHAT KIND OF DOCUMENTATION MUST I KEEP?

You must keep a written record of audit findings and your response to those findings and documents that deficiencies have been corrected. You must keep the two most recent audit reports, but you need not keep a report that is more than five years old. You may also want to keep a record of who conducted the audit, but you are not required to do this.

WHERE TO GO FOR MORE INFORMATION

- Guidelines for Auditing Process Safety Management Systems, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1993.

Q & A
AUDITS

Q. Does the compliance audit requirement cover all of the Part 68 requirements or just the prevention program requirements?

A. The compliance audit requirement applies only to the prevention programs under Subpart C. If you have a Program 2 process, you must certify that you have evaluated compliance with the Program 2 prevention program provisions at least every three years to verify that the procedures and practices developed under the rule are adequate and are being followed. You may want to expand your audit to check other part 68 elements, but you are not required to do so.

EXHIBIT 6-10
SAMPLE AUDIT CHECKLIST
FOR SAFETY INFORMATION AND HAZARD REVIEW

Element	Yes/No/NA	Action/Completion Data
Safety Information		
MSDSs up-to-date and available to workers?		
Maximum intended inventory determined?		
Determined Safe upper and lower temperature? Safe upper and lower pressures? Safe process flow rates? Compositions?		
Equipment specifications Tanks? Piping? Pressure relief valves? Emergency shutoff valves? Gauges? Pumps? Compressors? Hoses?		
Hazard Review		
Has equipment been inspected to determine if it is designed, manufactured, installed, and operated according to industry standards and codes?		
Are the results of the inspections documented?		
Have inspections been conducted after every major change?		

6.8 INCIDENT INVESTIGATION (§ 68.60)

Incidents can provide valuable information about site hazards and the steps you need to take to prevent accidental releases. Often, the immediate cause of an incident is the result of a series of other problems that need to be addressed to prevent recurrences. For example, an operator's mistake may be the result of poor training. Equipment failure may result from improper maintenance or misuse. Without a thorough investigation, you may miss the opportunity to identify and solve these problems.

WHAT DO I NEED TO DO?

You must investigate each incident which resulted in, or could have resulted in, a catastrophic release of a regulated substance. A catastrophic release is one that presents an imminent and substantial endangerment to public health and the environment. If the incident meets the criteria for including in the five-year accident history section of your RMP, it warrants an incident investigation. Exhibit 6-11 briefly summarizes the steps you must take for investigating incidents. You should also consider investigating minor accidents or near misses because they may help you identify problems that could lead to more serious accidents; however, you are not required to do so under part 68.

EXHIBIT 6-11
INCIDENT INVESTIGATION REQUIREMENTS

✔**Initiate an investigation promptly**.	Begin investigating no later than 48 hours following the incident.
✔**Summarize the investigation in a report.**	Among other things, the report must identify the factors contributing to the incident. Remember that identifying the root cause may be more important than identifying the initiating event. The report must also include any recommendations for corrective actions. Remember that the purpose of the report is to help management take corrective action.
✔**Address the report's findings and recommendations.**	Establish a system to address promptly and resolve the incident report findings and recommendations and document resolutions and corrective actions.
✔**Review the report with your staff and contractors.**	You must share the report - its findings and recommendations - with affected workers whose job tasks are relevant to the incident.
✔**Retain the report.**	Keep incident investigation summaries for five years.

HOW DO I START?

You should start with a simple set of procedures that you will use to begin an investigation. You may want to assign someone to be responsible for compiling the initial incident data and putting together the investigation team. The investigation will proceed more smoothly if your team includes personnel who have been trained in accident investigation methods and your investigation procedures. If you have a small facility, your "team" may be one person who works with the local responders, if they were involved.

The purpose of the investigation is to find out what went wrong and why, so you can prevent it from happening again. Do not stop at the obvious failure or "initiating event" (e.g., the hose was clogged, the operator forgot to check the connection); try to determine why the failure occurred. In many cases, the underlying cause will be what matters (e.g., the operator did not check the connection because the operating procedures and training did not include this step). If the accident occurred because of operator error, you should determine if the operator made the mistake because he or she had been trained inadequately or trained in the wrong procedures or because design flaws made mistakes likely. If you write off the accident as operator error alone, you miss the chance to take the steps needed to prevent such errors the next time. Similarly, if equipment fails, you should try to decide whether it had been used or maintained improperly.

Remember, your goals are to prevent accidents, not to blame someone, and correct any problems in your prevention program. In this way, you can prevent recurrences.

In some cases, an investigation will not take long. In other cases, if you have a complex facility, equipment has been severely damaged, or the workers seriously hurt, an investigation may take several days or weeks. You should talk with the operators who were in the area at the time and check records on maintenance (another reason for keeping logs). If equipment has failed in an unusual way, you may need to talk to the manufacturer and your trade association to determine if similar equipment has suffered similar failures.

You must develop a summary of the accident and its causes and make recommendations to prevent recurrences. You must address each recommendation and document the resolution and any actions taken. Finally, you must review the findings with operators affected by the findings.

WHAT KIND OF DOCUMENTATION MUST I KEEP?

You must maintain the summary of the accident investigation and recommendations and document resolutions and corrective actions. A sample format is shown in Exhibit 6-12 that combines all of these in a single form. Note that the form also includes accident data that you will need for the five-year accident history. These data are not necessarily part of the incident investigation report, but including them will create a record you can use later to create the accident history.

WHERE TO GO FOR MORE INFORMATION

Although the reports below target the chemical industry, you may find useful information in them:

- *Guidelines for Investigating Chemical Process Incidents*, Center for Chemical Process Safety of the American Institute of Chemical Engineers 1992.

- *Guide for Fire and Explosion Investigations* (NFPA 921), National Fire Protection Association.

EXHIBIT 6-12
SAMPLE INCIDENT INVESTIGATION FORMAT

Ammonia Tank Release		
Date: May 15, 2003; 3 pm	Substance: Ammonia	Quantity: 2 tons
Duration: 2 hours	Weather: 82 F, 8 mph winds	Date Investigation Started: May 16, 2003
Description:	Unloading hose split open and spilled substance; operator was in the main building and failed to notice spill for several minutes	
Findings	**Recommendations**	**Actions**
Hose split because the pressure was too great	Replace hose with higher pressure hose Revise procedures for checking on pressure	Replaced hose as recommended; revised procedures; conducted training on new procedures
Operator failed to stay at the tank during loading	Conduct refresher training to stress necessity of remaining at the tank during loading	Refresher training provided; safety meetings added and held on a monthly basis to review safety issues
Tank required manual shutoff	Determine if automatic shutoff valve is feasible	Automatic shutoff valve installed

6.9 CONCLUSION

Many of you will need to do little that's new to comply with the Program 2 prevention program, because complying with other Federal rules, state requirements, and industry-specific codes and standards results in compliance with many Program 2 elements. And if you've voluntarily implemented OSHA's PSM standard for your Program 2 process, you'll meet the lesser Program 2 prevention program requirements. No matter what choices you make in complying with the Program 2 prevention program, keep these things in mind:

- Integrate the elements of your prevention program. For Program 2 owners and operators, a major change in any single element of your program should lead to a review of other elements to identify any effect caused by the change.

- Make accident prevention an institution at your site. Like the entire risk management program, a prevention program is more than a collection of written documents. It is a way to make safe operations and accident prevention the way you do business everyday.

- Check your operations on a continuing basis and ask if you can improve them to make them safer as well as more efficient.